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Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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07 AIRCRAFT PROPULSION AND POWER 2505

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Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

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Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software*.

83 ECONOMICS AND COST ANALYSIS 2622
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 2622
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 2622
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 2624
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 2625
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 2626
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 2626
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 2626
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

GENERAL

99 GENERAL N.A.

Note: N.A. means that no abstracts were assigned to this category for this issue.

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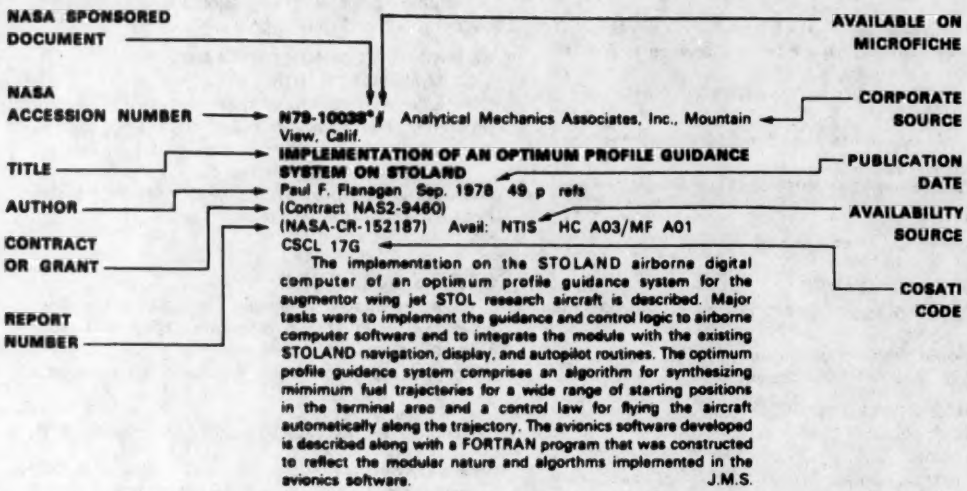
TYPICAL CITATION AND ABSTRACT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N79-10038*# Analytical Mechanics Associates, Inc., Mountain View, Calif.
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TITLE
IMPLEMENTATION OF AN OPTIMUM PROFILE GUIDANCE SYSTEM ON STOLAND
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The implementation on the STOLAND airborne digital computer of an optimum profile guidance system for the augmentor wing jet STOL research aircraft is described. Major tasks were to implement the guidance and control logic to airborne computer software and to integrate the module with the existing STOLAND navigation, display, and autopilot routines. The optimum profile guidance system comprises an algorithm for synthesizing mimimum fuel trajecteries for a wide range of starting positions in the terminal area and a control law for flying the aircraft automatically along the trajectory. The avionics software developed is described along with a FORTRAN program that was constructed to reflect the modular nature and algorithms implemented in the avionics software. J.M.S.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, FLIGHT/PROPULSION CONTROL COUPLING AND DYNAMIC INTERACTION

R.L. Heimgold, Lockheed Electronics Co. Inc., *Los Angeles, California* (DF138280; F33615-76-C-3128)

Currently, suitable techniques are not available for analysis and synthesis of dynamic interactions between flight and propulsion controllers on military aircraft, for purposes of developing control coupling techniques. The objective of this program is to develop methods and data base for design and implementation of flight/propulsion control coupling (FPCC) systems in fighter aircraft. In flight-propulsion control coupling, functional control parameters and system elements are blended to enable cooperative dynamic operation, with potential dramatic improvements in maneuverability, agility, air superiority, and airframe-propulsion compatibility. Jet flap and vector thrust classes of aircraft are to be considered.

The program will extend and refine the preliminary design of combat flight control modes for the jet flap aircraft which was developed in project 19870254. Emphasis will be on deceleration and turning modes, and integration with aircraft and engine stability loops. The areas of control, aerodynamic, and functional interaction between propulsion system, control surfaces, and airframe will be identified by review of past and current research and development, and problem areas experienced on modern military aircraft in the inventory. Maximum utilization will be made of available control technology and computer simulations in the respective areas of aerodynamics, flight control, and propulsion dynamic analysis to develop the analytical tools for evaluation of control interaction. Detailed analysis and simulation will be performed on the configuration selected, to define interaction parameters, and generate control coupling requirements. Plans for flight demonstration will be outlined.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0002, IMPROVED METHODS FOR PREDICTING SPECTRUM LOADING EFFECTS

J.B. Chang, Rockwell International Corp., *International Airport, Los Angeles, California* (DF140670; F33615-77-C-3121)

MIL-A-83444 and MIL-A-8866B both require the capability to predict the effects of spectrum loading on aircraft safety and durability. The impact of these effects on such design parameters as cost, weight, material and configuration must be assessed at the earliest possible phase of the aircraft design cycle. Current state-of-the-art techniques involve detailed cycle-by-cycle analysis of complex flight-by-flight load histories. These analyses are time consuming and sophisticated, making them unsuitable for use in the preliminary design stage and very expensive to use for the detailed analysis stages. The objective of this effort is twofold: (1) develop more efficient and economical models for characterizing spectrum effects and (2) develop techniques for implementing the specifications at the preliminary design stage. Accomplishment of these objectives will permit economical, efficient application of safety and durability criteria throughout the life cycle of USAF aircraft.

A large experimental data base exists relative to spectrum loading effects on crack growth. The approach will be to assess this data base to isolate the significant parameters which characterize the spectrum effects at various levels of analysis such as preliminary design, force management, and detailed failure analysis. Methodology will be developed to relate the spectrum effects to damage accumulation. Emphasis will be placed on development of handbook methods as well as computer programs. Results will be incorporated in the USAF damage tolerant design handbook.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0003, FLIGHT TEST HEATING EXPERIMENT

L.A. Cassel, Science Applications Inc., *1200 Prospect St., La Jolla, California* 92037 (DF139840; F33615-77-C-3043)

Interference heating is the most significant but least understood of the aerothermodynamic problems of designing a high-speed aircraft. Though the effects are highly localized, the heating rates due to shock wave impingement are severe. Of particular concern is the heat conducted into the actuating mechanism of missile control fins, since bearing surfaces and hydraulic systems have relatively low temperature limits. Exceeding these limits could result in loss of flight vehicle control. Since these structural temperatures are directly related and sensitive to the surface heating rates, the interference heating must be defined. therefore, the objective of this effort is to develop and design an aerodynamic heating experiment for the National Hypersonic Flight Research Facility or similar vehicle to validate and extend ground-based test data and analyses on three-dimensional shock interaction phenomenon.

Available correlations of ground test data will be used to determine the type and location of flight test instrumentation. Electronic equipment will be selected, the flight vehicle modifications will be designed, and a final report on the flight data correlation and application will be prepared.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0004, ADVANCED PARACHUTE CONTAINER DESIGN

G.R. Drew, U.S. Dept. of Defense, Navy, National Parachute Test Range, *El Centro, California* 92243 (DN695423)

(a) To provide fleet ejection seats with parachutes permanently sealed and protected against the operational environment. (b) To eliminate periodic repack cycle and withstand indefinite storage life and 15 years in service on ejection seat. (c) Reduce packaging weight by 30% and volume by 65%. (d) Eliminate 95% of service maintenance requirements. (e) Eliminate in-flight unavailability type malfunctions. (f) Eliminate parachute canopy wear and tear. (g) Reduce parachute system life cycle cost by 20 to 30%. (h) Increase parachute reliability.

Identify materials and processes to establish feasibility of packaging parachute canopies to provide 100% protection of canopy against the fleet operational environment. Concept includes 'one time packaging' in factory under 100% quality control. Test units will be manufactured and subjected to environmental, flight, airdrop, and ejection seat testing. Units will be

mounted on the back of ejection seats where they will be afforded maximum protection against wear and tampering, and hindrance to deployment.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0005, ADVANCED TECHNOLOGY COUPLINGS (MODIFIED MISALIGNMENT COUPLINGS) FOR HELICOPTER TRANSMISSION SYSTEMS

R.A. Stone, United Technologies Corp., Sikorsky Aircraft Division, *N. Main St., Stratford, Connecticut* 06602 (DA0D3940; DAAJ02-74-C-0054)

This program will consist of the investigation of new as well as current helicopter coupling concepts with the overall objective of providing the technology necessary to design couplings characterized by improvements in performance (i.e., misalignment, speed, torque) and weight, very high reliability and good maintainability.

The program is a four (4) task program outlined as follows. Task I - the work to be performed shall consist of an extensive investigation of the capabilities and limitations of current helicopter and industrial couplings, with regard to speed, torque, misalignment, lubrication, reliability and maintainability. Task II - selected coupling candidates will undergo a detail design in conjunction with the formulation of an analytical design technique which will be applicable to any range of speed, torque, misalignment, etc., for the concepts chosen. Tasks III & IV - specific coupling configurations shall be fabricated and tested. All test data will be analyzed to substantiate the analytical design guide, to validate potential performance gains, and identify possible design deficiencies. All design deficiencies will be corrected by redesign with follow-on verification tests.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0006, DEVELOPMENT AND OPERATION OF AN AIR TRANSPORTATION RESEARCH INFORMATION SERVICE (ATRIS)

Unknown, National Academy of Sciences, National Research Council, Transportation Research Board, *2101 Constitution Ave. N.W., Washington, District of Columbia* 20037 (FA78WA-4243; FA161506 (TRAIS NO.))

A research information service has to be developed for operation of Air Transportation. The production of this service requires the contractor to 1) identify the target clientele, 2) distribute the product; 3) assess the information needs and wants of the target clientele; 4) input the operations, and 5) a final production of all the developments.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0007, REMOTE SENSING INSTRUMENTATION FOR GAS TURBINE ENGINES (NITRIC OXIDE)

N. Krull, U.S. Dept. of Transportation, Federal Aviation Admin., *800 Independence Ave. S.W., Washington, District of Columbia* 20590 (DN796816)

Document and explain the differences between the optical and sample extraction techniques for the measurement of nitric oxide in aircraft engine exhaust plumes.

Conduct a series of well-controlled experiments, using a series of combustion sources of nitric oxide with increasing complexity. Compare levels of nitric oxide as determined by UV and IR spectrometer and standard probe extraction methods.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

1.0008, AN INVESTIGATION OF STRESS-STRAIN HISTORY MODELING AT STRESS RISERS

J. Carroll, Lockheed Georgia Co., *86 S. Cobb Dr., Marietta, Georgia* 30060 (DF134900; F33615-75-C-3078)

The occurrences of fatigue cracks in tactical and strategic aircraft structures degrade structure strength, increase life cycle costs and impair fleet readiness. This program will be directed to development of a model to depict the stress-strain behavior that occurs at stress risers in aircraft structures. The development of an accurate model is essential for assessing fatigue crack initiation and to enable the design of future structures to resist crack initiation.

An experimental and analytical effort to model stress-strain behavior at stress risers is to be conducted in two phases. Phase I effort will investigate the adequacy of the selected experimental techniques and existence of meaningful variations in plastic strains at stress risers. Phase II effort, to be undertaken if phase I is successfully completed, will include the collection of a data base and the development of a stress-strain behavior model at stress risers.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0009, HIGH-TEMPERATURE RADIAL TURBINE DEMONSTRATION

D. Monson, General Motors Corp., Detroit Diesel Allison Div, *4700 W. 10th St., Indianapolis, Indiana* 46206 (DA0D4113; DAAJ02-77-C-0031)

To provide and demonstrate the technology required to economically manufacture a cooled, high-temperature, radial turbine with sufficient integrity and aerodynamic performance to meet future Army requirements for reliable, low-cost, high-performance, small gas turbine engines.

The program will be conducted in three phases. Phase I - detailed design and manufacturing process development. Phase II - fabrication. Phase III - mechanical integrity verification. The process will consist of casting the rotor blades with internal cooling passages utilizing existing techniques. This is followed by hot-isostatic-press (HIP) bonding the blades to a previously formed powder metal hub.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0010, INVESTIGATION OF ADVANCED R&M ANALYTICAL TECHNIQUES

J. Florence, Rail Co., *21 Harrison Ave., Baltimore, Maryland* 21220 (DA0E3796; DAAJ02-77-C-0080)

To perform experimental developmental or research work to support modeling and analysis in conducting DOD analyses of Army aircraft such as the CH-47D, UTTAS, AAH, and AH-1S and other systems such as SOTAS, XM-1, etc.

The contractor will provide engineering and programming support for maintaining and updating the ARMS models as required.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0011, ARMS MODEL INCREASED CAPABILITIES MODS

J. Florence, Rail Co., *Executive Plaza 3, Cockeysville, Maryland* 21031 (DA0D4082; DAAJ02-76-C-0034)

The contract provides for the expansion of the Army Reliability and Maintainability Simulation (ARMS) model to provide the capability to simulate up to four types of aircraft, move aircraft to higher levels of maintenance, and include more than one combat threat. This contract has been modified to include a user's manual for the ARMS model to allow wider use of the computer model by any DOD agency.

Based on previous experience with the ARMS model, a list of enhancements was generated that would allow an analyst greater flexibility when using the computer program. The ARMS model will be reprogrammed to include these enhancements.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0012, GUST RESPONSE ALLEVIATION FOR A HINGELESS HELICOPTER ROTOR IN THE PRESENCE OF SINUSOIDAL VERTICAL GUSTS

E.A. Witmer, Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics & Astronautics, 77 *Massachusetts Ave., Cambridge, Massachusetts* 02139 (DN890068; N00019-77-C-0535)

Helicopters utilizing rotors with hingeless blades show great promise for future military and commercial applications. Much of the technology required for the development of such aircraft is available, but adequate understanding of the aero-elastic response of large flexible rotor blades to atmospheric turbulence has not yet been achieved. Such understanding is necessary during the preliminary design phase in evaluating the fatigue characteristics of the rotor and ride qualities of the vehicle, and, if necessary, in the development of suitable gust alleviation devices.

The contractor will perform a study of a wind tunnel model of a three-bladed hingeless rotor in simulated cruising flight in the presence of sinusoidal vertical gusts. Methods of rotor blade gust alleviation will be studied. As a first step, criteria will be established by which various alleviation methods can be evaluated. With the help of the theoretical analyses, a rotor-blade-alleviation system will be designed and evaluated. The results of this investigation will determine the adequacy of the structural model and the utility of the analysis as a tool for designing rotor-blade-gust-alleviation systems. The contractor will correlate the experimental model blade motions and stresses with theoretical predictions using the previously developed theory.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0013, MATERIAL PROPERTY CHARACTERIZATION FOR ANALYSIS OF MILITARY PAVEMENTS

W.R. Barker, U.S. Dept. of Defense, Army, Corps of Engineers, Waterways Experiment Station, *P.O. Box 631, Vicksburg, Mississippi* 39180 (DA0L8185)

To develop methodology for characterizing the structural properties of various types of pavement materials and to formulate this methodology into definitive procedures that will yield quantitative parameters for design of road and airfield pavements using existing or newly developed theoretical and semi-theoretical criteria.

A range of materials that are acceptable for use in the design of pavements will be considered. Various types of laboratory test procedures will be studied to determine methods of integrating the quantitative output of acceptable laboratory tests with conventional material acceptability standards such as gradation, plasticity, etc. Material characterization procedures will be developed to provide the user with direct and/or indirect methods of obtaining quantitative design parameters.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Waterways Experiment Station

1.0014, WOVEN AND NON-WOVEN FABRICS IN AIRPORT CONSTRUCTION

H. Ulery, U.S. Dept. of Defense, Army, Corps of Engineers, Waterways Experiment Station, *P.O. Box 631, Vicksburg, Mississippi* 39180 (FA78WAI-837; FA161214 (TRAIS NO.))

This Engineering Requirement (ER) defines the work necessary to develop criteria for the use of woven and non-woven fabrics in airport pavement. This will be a two-phase effort; the first phase will be a literature search - state-of-the-art report describing available material and its uses. Phase 2 will be a research effort to provide criteria for revision of the FAA Advisory Circular on drainage and will also include other uses such as emergency or temporary construction and reflection cracking.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0015, MANUAL CONTROL - INVESTIGATION OF PILOT PERFORMANCE IN TRACKING CONTROL TASKS UNDER DYNAMIC ENVIRONMENTAL CONDITIONS

J.G. Curtin, McDonnell Douglas Corp., *P.O. Box 516, St. Louis, Missouri* 63166 (DN675596; N00014-76-C-0883)

Manual control functions place high demands of attention and workload upon pilots, particularly in single place tactical aircraft. These demands upon the pilot will increase with the advent of CCV (Controlled Configured Vehicle) designs and high-acceleration cockpits. Although stability augmentation techniques, autopilot systems and other concepts have been developed to unburden pilots in performing primary flight tasks, insufficient attention has been given to improve control designs for secondary manual tracking functions (e.g., radar target and navigation tracking). This research is concerned with investigating the potential of alternative control configurations for reducing pilot workload and improving performance in secondary tracking tasks under dynamic environmental conditions.

Fingertip tracking controls integrated into an aircraft throttle grip are investigated in a motion base simulator under different levels of task loading and low-frequency vibration. Variables included two types of control (force and displacement), four levels of vibration (none, moderate turbulence, heavy turbulence, and broadband), and two levels of task loading (low, consisting of either flight control or tracking, and high, consisting of both simultaneously).

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

1.0016, LIFT SYSTEM INDUCED AERODYNAMICS OF V/STOL AIRCRAFT IN DYNAMIC ENVIRONMENT OF A MOVING DECK

J. Kamman, McDonnell Douglas Corp., *P.O. Box 516, St. Louis, Missouri* 63166 (DN881373; N62269-77-C-0365)

The technical objective is to experimentally investigate the jet induced aerodynamics of a V/STOL aircraft operation in the dynamic environment of a moving deck. This contract supports work unit ZA601, Agency Accession No. 681080.

A parametric test will be conducted using two, scaled models of V/STOL aircraft of different configurations. Test parameters include aircraft height above deck, number and location of jet nozzles, and nozzle pressure ratio for deck motions including pitch, roll, and heave of various rates and amplitudes. Measured data will include the three components of force and moment for both static and dynamic conditions.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0017, EFFECTS OF DRIVING GAS TEMPERATURE ON EJECTOR PERFORMANCE

R. Dejneka, U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center, *Trenton, New Jersey* 08628 (DN796800)

Determine the effect of driving gas temperature on ejector performance. Thrust augmenting ejectors appear to have a good potential for V/STOL and other low-speed propulsion application.

A low-volume ejector model which was developed by the Flight Dynamics Research Corporation will be tested at the Naval Air Propulsion Test Center (NAPTC) with driving gas at ambient, 400 and 800 F. Testing will be conducted at sea level, static conditions. Measurements will include: thrust, driving gas flows, and diffuser exit temperature and velocity profiles.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0018, CREW STATION DESIGN FACILITY FEASIBILITY STUDY

S. Lacarrubba, Grumman Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DF141530; F33615-77-C-3067)

This effort will support the development of new display concepts for advanced aerospace crew stations. A USAF pilot opinion survey identifies numerous serious cockpit lighting and display legibility problems which impact day/night mission performance. The increasing numbers of multipurpose light emitting displays (cathode ray tube displays) used in conjunction with complicated future weapon systems further substantiates the need for definitive display design criteria. The objective of this effort is

to determine the feasibility of building a test facility capable of simulating the broad range of extreme illumination conditions experienced in air-to-air combat, air-to-ground weapons delivery, and other critical day/night mission phases. Dynamic lighting simulation capability will permit evaluating cockpit lighting and display legibility from a systems viewpoint within the context of more realistic mission conditions. This capability will also permit formulation of meaningful cockpit lighting and display legibility design criteria.

This effort is the initial phase in the development of a crew station design facility. A feasibility and design study to define trade offs, technical limitations and overall design of the test facility will be contracted. The study will provide information concerning description, location, type of simulated features (such as air targets, ground targets, flares, and extreme ambient illumination sources) and the simulator enclosure itself. The results of the study will be used in a future detailed design study preliminary to construction of the facility.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0019, ONE-HORSEPOWER MOTOR

G. Egan, I M C Magnetics Corp., *570 Main St., Westbury, New York* 11591 (DN881391; N62269-78-C-0397)

To develop motors applicable to the 27OVDC power system under development for future naval aircraft. This contract supports work unit ZA601, Agency Accession No. DN681080.

To investigate the use of newly developed high-energy product samarium cobalt permanent magnets for DC brushless motor designs to achieve desired motor performance characteristics and size and weight comparability with present AC motor designs.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0020, PRELIMINARY DESIGN OF A COMPOSITE WING FOR NAVY V/STOL PROTOTYPE

R. Gehring, Rockwell International Corp., Columbus Aircraft Division, *4300 E. 5th Ave., Columbus, Ohio* 43216 (DN581067; N62269-74-C-0577)

To advance fibrous composite aerospace structures technology by the preliminary design of a major structural component representative of new fighter aircraft and to provide the basis for advanced development efforts to demonstrate the practicality of such structures. To support the navy V/STOL prototype program by focusing on the preliminary design of a lightweight, highly reliable wing assembly with sufficient similarity to the final systems configuration to minimize transition from development to production status. To provide the technical basis, the economic analysis, and (by demonstration) the confidence needed for large-scale commitment of composites to future Navy aircraft structures. This work is in support of work unit ZA601, 'Aircraft Technology', Agency Accession No. 681080.

Conduct the preliminary design of a full-scale composite wing structure forward of the augmenter for the XFV-12A V/STOL fighter attack prototype. Fabricate one structural test specimen representing this structure between wing stations 0 and 79. 5.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0021, VISCOUS AND INTERACTING FLOW FIELDS ABOUT FLIGHT VEHICLES

A.W. Fiore, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF138520)

The problem is to improve the technical base in order to predict pure turbulent boundary layers and viscous interactions so that such items as pressure distribution, local velocity profiles, skin friction, and heat transfer on military aircraft and maneuvering re-entry nose cones can be predetermined. The technical objective is to generate fundamental data on the characteristics of high-speed viscous and interacting flow fields about vehicles at Reynolds numbers sufficiently high so that transitional and turbulent boundary layers are present. The resulting data will make possible the prediction of separated flow fields for aircraft flying at high angles of attack.

The approach to solving these problems will be experimental efforts to gain knowledge of both two- and three-dimensional viscous and interacting flow fields. The emphasis will be on (a) transitional and pure turbulent boundary layers, (b) turbulent viscous-inviscid interacting flow fields, (c) the application of boundary layer control for the purpose of reattaching separated flows at very high angles of attack as well as decreasing the overall drag of the flight vehicles, and (d) shock boundary layer interactions. These studies will include various types of pressure gradients, surface roughness, and wall temperature parameters. Tests will be conducted at speeds extending from transonic to hypersonic Mach numbers.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0022, CLOSED-LOOP FLYING QUALITIES ANALYSIS METHODS

F.L. George, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF142270)

This work unit supports development of new flying qualities design criteria for military aircraft. The complex nature of advanced military aircraft demands that flying qualities analysis include the total closed-loop system consisting of airplane, control, displays, and pilot(s). This work unit will improve the capability for including consideration of the pilots' dynamics in realistic mission-oriented flying tasks. The ability to analyze and confidently predict flying qualities during the design of advanced military aircraft will improve mission effectiveness of the final product. Furthermore, it will reduce development costs by reducing the amount of experimental flying qualities testing needed and by eliminating potential design changes involved when flying qualities deficiencies aren't identified until the flight test program.

Several approaches to analytically accounting for pilot dynamics have been proposed and demonstrated using simplified tracking tasks. These results will be reviewed and refinements or extensions of existing methods needed for realistic flying qualities analysis will be identified. The most promising analytical techniques will be extended as appropriate and their validity for analyzing realistic mission-oriented flying tasks will be demonstrated. The pacing factor in this effort will be the availability of data to validate the revised or newly developed pilot-vehicle analysis methods.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0023, SIMULATION VERIFICATION

W.W. Harrington, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF141680)

This work unit supports the development and maintenance of analysis capabilities, engineering simulation capabilities, and experimental testing methods for flight/man-machine system evaluation. It is directed toward the development of basic simulation technology as required by manned engineering flight simulation for fighter aircraft development. Specific objectives include: 1) verification of a specific aircraft model, including airframe stability and thrust vs. drag, 2) verification of the real time simulation of this aircraft model, 3) development of parameter identification techniques as a verification tool, 4) development of data reduction techniques and software for the evaluation of the utility and adequacy of simulator cues for the air-to-air combat environment, and 5) evaluation of the adequacy of simulator cues as provided by the large-amplitude multimode aerospace research simulator (LAMARS) at the AFFDL for the air-to-air combat environment. The adequacy of simulator cues for the air-to-air combat environment as provided by the dual flight simulator (DFS) in the Federal Republic of germany will also be evaluated. This analysis will contribute to the technology required for the appropriate development, adaptation, and integration of simulation equipment in support of AFFDL manned engineering flight simulation programs.

Flight test and simulation data will be obtained from a flight test/simulation program containing five interrelated phases including vehicle performance testing, conventional stability testing, parameter identification testing, handling qualities during tracking testing, and terminary air-to-air gunnery testing with an LCOSS sight. Both subjective and quantitative data will be evaluated. The data reduction techniques and software will be developed as part of this effort. The analysis will be applied to data from the LAMARS and also to data from the DFS which will be provided under MWDDEA AF 75 g 7430.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0024, DIGITAL LOAD CONTROL APPLIED TO FULL-SCALE AIRFRAME FATIGUE TESTS

N.K. Mondol, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF130760)

This work unit is directed toward improvements and advances in full-scale airframe fatigue test supporting systems for the AFFDL structures test facility. Specific problem areas are (a) load control, (b) function generation, and (c) meaningful control information display for large-scale multi-channel fatigue tests. The principal objective is the design of a practical, low-cost digital load control system suitable for application to large fatigue tests, with particular emphasis on built-in safety, accuracy, reliability and maintainability. Large fatigue tests are expensive to set up and operate by nature of their complexity and multitude of specialized test equipment. Any savings in cost or complexity on a single-channel basis is multiplied and becomes significant in multi-channel tests.

This work unit will advance digital load control technology achieved under project 1347, task 03, work unit 02. Resources to be utilized include (a) participation by the AFIT Electrical Engineering Department with control theory as applicable to fatigue testing, (b) contractor-furnished hardware and software for control and display systems, and (c) in-house development and testing. Work unit will test several single-channel prototype digital microprocessor systems before constructing a multi-channel device.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0025, PROPULSION TECHNOLOGY

E.E. Bailey, U.S. National Aeronautics & Space Admin., Office of Aeronautics & Space Technology, Lewis Research Center, *21000 Brookpark Rd., Cleveland, Ohio* 44135 (DA0E3532)

Conduct exploratory development programs for advanced propulsion and drive train components relevant to future Army aircraft application. Provide technological basis for evaluation of concepts for improvement and application including considerations for related needs in materials and fabrication techniques.

Analytical and experimental studies are conducted on Army-funded NASA-administered contracts with private industry and universities. Typical programs involve analysis, design, fabrication, and test of breadboard hardware. The primary areas to be emphasized are related to turboshaft engine technology and associated helicopter drive-train systems. Components considered include: inlet particle separators, compressors, combustors, turbines, seals, bearings, shafting, gears, clutches, couplings, and thrust producers.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0026, AIRCRAFT DEPLOYED DROPSONDE/BATHYTHERMOGRAPH

M.C. Werst, Analytics Inc., *2500 Maryland Rd., Willow Grove, Pennsylvania* 19090 (DN881536; N62269-77-C-0362)

Provide a vertical refractive processing system for use with the ASW aircraft.

Prepare preliminary documentation prerequisites for approval for services use (ASU) and release for production (RFP). Emphasis will be placed on the technical requirements for operational analysis. To collect and document technical and management information on the meteorological measuring systems (MMS) to support NAVAIR in their preparation of a Navy Decession Coordinating Paper (NDCP) for MMS.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Sensors & Avionics Tech Directorate

1.0027, A/C MOTION SENSITIVITY STUDY

T.F. Langham, Arnold Research Org. Inc., *Arnold Air Force Base, Tullahoma, Tennessee* 37389 (DF421051; F40600-77-C-0003)

To study the importance of dynamic cross and cross-coupling derivatives in aircraft motion simulation.

The maneuvering flight characteristics of three aircraft will be analyzed using the 6-D0F aircraft stability program. Sensitivity of aircraft motion to various cross and cross-coupling derivatives will be examined by varying these derivatives over ranges surrounding nominal values.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Arnold Engineering Development Center

1.0028, HELICOPTER OBSTACLE STRIKE TOLERANCE

B.P. Gupta, Bell Helicopter Co., Division of Textron, *P.O. Box 482, Fort Worth, Texas* 76101 (DA0E3780; DAAJ02-77-C-0049)

To develop design concepts and criteria which will reduce the frequency and severity of Army helicopter accidents attributable to obstacle strikes. This effort is directed at both current operational and future Army helicopters.

Define the problem in terms of strike causing obstacles and operations, resulting failure modes and mishap class - strike - cost -injury relationships. Formulate and analyze strike tolerance concepts for fuselage, landing gear, and rotors. Select the most promising concepts considering effectiveness, cost, aircraft performance, and retrofit suitability. Derive helicopter obstacle strike tolerance design criteria for system as a whole.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0029, ADVANCED STRUCTURAL DESIGN

R.M. LaSalle, General Dynamics Corp., *P.O. Box 748, Fort Worth, Texas* 76101 (DF139510; F33615-77-C-3042)

Advanced composites exhibit considerable potential for performance and cost benefits in primary airframe members of Air Force aircraft. The problem lies in generating efficient, reproducible, low-cost structural configurations responsive to the unique characteristics of advanced composites and the requirements of military airframes. The objective of this program is to generate and validate a new design concept for advanced composite wings for fighter-type aircraft incorporating a new approach for manufacturing the lower skin and interior spars to improve structural efficiency and reduce life cycle costs of composite airframe construction. Demonstration of the structural integrity of the conceptual configuration proposed along with system effectiveness and economic analysis will provide future airframe designers with an efficient, economic alternative for advanced military aircraft.

A wing box demonstration article that models the same identical portion of the F-16A wing as that modeled in the advanced metallic laminated wing structures program, contract F33615-75-C-5178, will be designed of advanced composites incorporating imbedded spar cap features which can provide significant cost reductions over conventional mechanically fastened composite structure. Critical elements of this design configuration will be evaluated by a series of element tests. Fabrication of these structural elements will provide an opportunity for preliminary assessment of manufacturing methods and costs for use in comparing with production hardware and advanced configurations being studied under contract F33615-75-C-5178.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0030, ASSEMBLY COST FOR COMPOSITE STRUCTURES
L. McKenzie, General Dynamics Corp., *P.O. Box 748, Fort Worth, Texas* 76101 (DF140250; F33615-77-C-3076)

The Air Force, in order to maintain air superiority, must obtain advanced aerospace vehicles and modify existing systems. Reliable cost and weight analysis is required if these systems are to have the minimum cost for the acceptable level of performance. The objective of this effort is to develop a preliminary design level technique for the cost estimation of advanced composite flight vehicle structures. This will provide a high level of confidence in the cost of composite construction.

This study will integrate and expand on previously developed methodology provided by the Air Force contract F33615-75-C-3103 and will support the development of the structural technology evaluation program. The model will use the industrial engineering standards approach which will generate the desired confidence and provide a high-quality cost estimate.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0031, SECURITY SYSTEMS ANALYSIS
Unknown, Inst. for Defense Analyses, *400 Army Navy Dr., Arlington, Virginia* 22202 (FA77WA-3974; FA160074 (TRAIS NO.))

The objective is to perform a security systems analysis to insure that the equipment selected under the Civil Aviation Security R&D Program and procedures will detect weapons and explosives effectively. As part of this effort, the contractor will determine whether total costs to the airlines and airport operators are appropriate to the level of explosive threat and whether the weapon and explosive detection systems are currently being developed by or for the FAA are compatible with commercial aviation operations.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0032, HT SS 78-03 - LOW RCS SYSTEM CONCEPT INVESTIGATION - ARMY HELICOPTER
Unknown, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Applied Technology Lab., *Fort Eustis, Newport News, Virginia* 23604 (DA0E3822)

Conduct analysis and experimentation to develop an optimum low RCS shape for application to a helicopter airframe.

Previous RCS reduction investigations indicate significant reduction in RCS signature may be achieved by shaping. This effort will define the shaping for application to the primary structure of a helicopter for future practical evaluation. An analysis will be conducted using ATL RCS prediction methods and data developed from previously conducted fuselage LRCS shaping studies to define an optimum shape. Model and full-size mock-ups will be fabricated for fit, function, and RCS evaluation.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0033, HT 78-40 - AUXILIARY ROTOR ENERGY CONCEPTS FOR AUTOROTATION
Unknown, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Applied Technology Lab., *Fort Eustis, Newport News, Virginia* 23604 (DA0E3838)

Analytically explore auxiliary energy concepts to reduce helicopter main rotor rpm decay during autorotation.

Conduct a literature search for pertinent historical data. Compute, using the Sikorsky-developed autorotation maneuver program (AMP), and catalog the autorotation capability of several helicopters with various disk loadings at selected points within the respective light envelopes (that is, define the miminum h-v diagrams). Select candidate methods or concepts of auxiliary rotor energy; analyze these concepts with the AMP to define auxiliary energy contribution; determine efficacy of auxiliary energy concepts on various types and disk loading helicopters; estimate concept complexity, size and weight; simulate auxiliary energy concept effectiveness to reduce the baseline vehicles h-v envelope; and determine normal operational flight penalties.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0034, HT RM 78-02 - DESIGN AND FABRICATION OF EXPERIMENTAL TEST HARDWARE - EXTERNAL CARGO OPERATIONS
J.A. Vichness, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Applied Technology Lab., *Fort Eustis, Newport News, Virginia* 23604 (DA0E3808)

To improve the capabilities of helicopters in performing external cargo operations in tactical and logistical support missions.

Utilizing a contract-support house task, design analyses of contractor and in-house identified technologies will be conducted in relation to overall aircraft systems and current/future combat support concepts. In-house efforts will utilize the facilities of the ATL, structures (wind tunnel), and aero laboratories and experimental flight hardware for verification of selected technology concepts and to identify technology voids.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0035, HEAD-UP DISPLAY FOR KC-135 BOOM OPERATORS CONTROL STATION
F. Brem, Sundstrand Data Control Inc., *Overlake Industrial Park, Redmond, Washington* 98052 (DF142460; F33615-78-C-3617)

This work unit supports the division mission FG03 by developing an innovative flight control concept for safely expanding the operational capability of the KC-135 aerial refueling aircraft. A major problem associated with aerial refueling is the precise control of the boom. The boom operator at present must visually estimate distances and angles while operating controls which cannot be seen simultaneously with the real world. The objective of this work unit is to evaluate a head-up display as a solution to this program. If a head-up display can aid the boom operator in precisely controlling the refueling boom, the Air Force can save resources in the training of boom operators (now in critical supply), and reducing the number of accidents attributed to boom operator fatigue.

The solid path HUD developed by the AFFDL will be installed and evaluated in an operational KC-135 aerial refueling aircraft to determine its potential usefulness as a boom operator's aid.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, CRYOGENIC STORAGE FOR SPACE TECHNOLOGY
R.O. Voth, U.S. Dept. of Commerce, National Bureau of Standards, *325 S. Broadway, Boulder, Colorado* 80302 (2750452)

PROJECT OBJECTIVE: Demonstrate the feasibility of safely and reliably producing solid/liquid mixtures (slush) hydrogen and oxygen in ground support equipment at launch facilities. Demonstrate the feasibility of safely and reliably storing and using slush oxygen and hydrogen in a zero-g environment.

PROJECT APPROACH: Experimentally determine superatmospheric (pressures above 1 atmosphere) production techniques, laboratory scale transfer characteristics, and mass gauging instruments required for slush oxygen and hydrogen. Analyze the storage, mixing, and transfer characteristics of slush hydrogen and oxygen while designing a slush cryogen experiment to be placed aboard the space shuttle laboratory.

PRIOR YEAR ACCOMPLISHMENTS: The power required to produce slush was measured to determine efficiency of production. Produced slush hydrogen for a preliminary test of a radio frequency mass gauging system.

SUPPORTED BY U.S. Dept. of Commerce, National Bureau of Standards

2.0002, HEAVY PAYLOAD PROGRAM
E.T. Byram, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN480104)

Develop and fly heavy space instrumentation matched to the capability of large low-cost carrier rockets (ARIES) and of large satellites (HEAC and the shuttle).

In the X-ray, gamma-ray region evaluation of emission from the natural background and from man-made objects profits from the increased sensitivity provided by large detectors. Pointed payloads and large sensors are developed and used: (1) to define the limits placed by nature on space military systems, (2) to augment technology for inspection of man-made objects in space, and (3) to study physical processes and systems not possible to study from the ground.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, EROSION MECHANISMS OF METALS
M.E. Gulden, Solar Turbines International, Research Laboratories, *2200 Pacific Hwy., San Diego, California* 92138 (DF053130; F49620-78-C-0104)

AF function - aircraft turbine engines are required to operate in global situations envolving dust, sand, ice and other air-borne solids. Deficiency - particulate ingestion results in the erosion of turbine air foils and reduces the efficiency and power. Objective - the objective of this research is to formulate and examine a general theory of erosion based upon the ductile/brittle properties of the material. How work contributes - this research will lead to more erosion-resistant turbine materials. Of particular interest will be the new intermetallic alloys, DS eutectics and new coatings developed for turbine applications.

The baseline erosion characteristics of five steels will be determined as a function of heat-treated hardness. Critical erosion and environmental test variables will be tightly controlled to define the effect of specific material properties on the erosion mechanisms. The threshold for erosion of a single composition will be determined as a function of its ductile-to-brittle transition, angle of impingement, particle size and velocity.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0002, TWO-DIMENSIONAL PHOTOCHEMICAL MODEL STUDIES
Unknown, Colorado State University, Graduate School, *Fort Collins, Colorado* 80523 (FA77WA-4039; FA160441 (TRAIS NO.))

The contractor shall furnish all of the qualified personnel, facilities equipment, services and material required to perform the effort set forth below: (Task 1) Model Refinement; (Task 2) Tracer Data; (Task 3) Water Vapor Budget; and (Task 4) Effects on Ozone.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

3.0003, DETECTION OF MATRIX STRESSES IN GRAPHITE/EPOXY COMPOSITES
P.K. Predecki, University of Denver, School of Engineering, Dept. of Chemical Engin & Metallurgy, *2115 S. University Blvd., Denver, Colorado* 80210 (DF048180; AFOSR-77-3284)

AF function - the function of nondestructive evaluation (NDE) in the Air Force is to save lives and resources through timely examination of aircraft and engine components to assure their continued safe operation. Deficiency - many inspection techniques have been developed for metals; however, despite the increasing use of polymer composites, there has not been an adequate development of NDE techniques for these materials. Objective - the objective of this work unit is to conduct research on the detection of matrix stresses in graphite/epoxy composites by NDE techniques. How work contributes - matrix stresses are indicative of the soundness of the composite and indicate degradation such as debonding, fiber breakage, and humidity infiltration.

A new application of X-ray stress analysis for detecting residual and applied stresses in the matrix of graphite/epoxy composites will be investigated. The method makes use of small amounts (less than 20 wt percent) of crystalline filler placed in the matrix of any desired ply or plies during the fabrication process.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0004, IMPROVED POWDERS FOR CERAMIC PROCESSING
P.F. Becher, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN680080)

To produce improved ceramic powders having fine particle size and with minimal contents of both cation and anion impurities. A secondary objective is to achieve improved mixing multiconstituent powders.

To prepare powders by vaporization of the appropriate metal or metals and reaction of that vapor with the appropriate gas, i.e. oxygen for oxides, nitrogen for nitrides, methane for carbides, and borane for borides. Mixing will be accomplished by simultaneous reaction, or by aerosol mixing, possibly using particle charging. Powders will be collected and processed in a controlled environment, avoiding contamination, to determine the degree of improvement that results in bodies fabricated from such powders.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0005, THE EFFECT OF MICROSTRUCTURAL FEATURES ON CORROSION FATIGUE OF HIGHSTRENGTH ALUMINUM ALLOYS
E.A. Starke, Georgia Inst. of Technology, School of Engineering, Dept. of Chemical Engin, *225 North Ave. N.W., Atlanta, Georgia* 30332 (DF051130; AFOSR-78-3471)

AF function - the longevity, reliability and safety of aerospace structures are related to the fatigue properties of the structural materials used. Fatigue phenomena are environment sensitive and the alternating moisture and temperature conditions experienced by aircraft are extreme handicaps when designing for fatigue resistance. Opportunity - corrosion fatigue is a prime cause of failure of the high-strength aluminum alloys used for aircraft structures and improvements in fatigue resistance await the understanding of alloy - environment -load relationships. Objective - this research will correlate microstructural features of structural aluminum alloys with cyclic stress/strain response and crack propagation under selected environmental conditions in order to distinguish those features which control the corrosion fatigue behavior. How work contributes - since aluminum alloys form a major portion of the material currently used for skin and other structural airframe applications, it is appropriate that they are the basis of this investigation.

Special high-strength aluminum alloys based on 7050, and special processing procedures have been selected for separating the effects of the primary microstructural variables - grain structure, subgrain structure, degree of recrystallization, alloy content and type of precipitate. After the relationships between these features and corrosion fatigue behavior have been established and understood, improvements in performance by alloy design can be expected.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0006, FRACTURE STUDIES OF HIGH-TEMPERATURE CERAMICS

D.L. Johnson, Northwestern University, Evanston Campus, Technological Inst., Dept. of Materials Science, *633 Clark St., Evanston, Illinois* 60201 (DF042280; AFOSR-76-2920)

AF function - the performance and cost of jet engines are factors of high interest in any flight vehicle design. Opportunity - ceramic materials offer increased performance and efficiency through higher operating temperatures and greater thermodynamic efficiency. The key factor in using ceramic materials is their high-temperature strength but brittle behavior. Objective - this study will determine the resistance of ceramic turbine materials to impact damage at temperatures up to 1400 degrees C and in various gaseous atmospheres. How work contributes - a knowledge of the factors influencing impact strength will allow rational materials selection and optimum design parameters to be established.

High-temperature impact and double-torsion fracture experiments will be performed on various silicon nitride, carbide, and composite ceramics. Impact fracture energies and K-1C values will be determined over a range of temperatures up to 1400 degrees C and at various impact velocities. Fracture data will be correlated with chemical composition and microstructure.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0007, SPECTRAL AND TOTAL EMISSIVITY AND REFLECTIVITY AT HIGH TEMPERATURES

R.E. Taylor, Purdue University, School of Engineering, Dept. of Aeronaut Astronaut & Engineering Science, *Executive Bldg., West Lafayette, Indiana* 47907 (DF047910; AFOSR-77-3280)

AF function - weapons delivery. Deficiency - development of laser-hardened materials for aircraft surfaces and system components and of nose-cone and nozzle materials, is hampered by lack of high-temperature data on thermophysical properties of most solids of possible interest. Objective - this program will obtain reliable experimental values of emissivity and reflectance as functions of wavelength (1 to 12 micrometers) and temperature (800 - 1800K) for selected key metallic and non-metallic materials. Transport properties of a reference poco graphite will also be measured. How work contributes - provides needed data for evaluation of candidate development materials, and will result in predictive methods for higher temperatures and related substances.

The multi-property apparatus is being improved and modified so that (a) normal spectral emissivity is measured simultaneously with other properties, (b) temperature range is improved in both directions, (c) non-conductors as well as metals can be measured, and (d) translucent materials can be investigated. Carbides and nitrides of boron and silicon, as well as graphite, carbon-carbon, and some metallic substances are being investigated. The same apparatus will be used to measure the thermal conductivity and electrical resistivity from room temperature to 2500K for two samples of poco graphite supplied by NBS.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0008, X-RAY PHOTOELECTRON SPECTROSCOPIC STUDIES OF ELECTRODE SURFACES

N. Winograd, Purdue University, School of Science, Dept. of Chemistry, *Executive Bldg., West Lafayette, Indiana* 47907 (DF043230; AFOSR-76-2974)

AF function - flight operations, communications, life support systems depend on auxiliary battery sources for power. Deficiency -there is a continuous need to attain longer life, high-energy, lighter weight batteries to meet power requirements. Objective - this research deals with the understanding of the surface chemistry of the electrode and how this chemistry can influence resulting electron transfer process. It includes the development of the X-ray photoelectron spectroscopic technique (XPS or ESCA) as an aid to elucidating electrode processes. How work contributes - the results will provide new information relevant to corrosion processes, electrocatalysis, and fuel cell and battery technology.

A testing and evaluation of methods for transferring surfaces of interest into the ultra-high vacuum environment of the ESCA spectrometer ill be undertaken. A characterization of the surface chemistry of a wide variety of metal, alloy, and metal oxide electrode systems after exposure to the relevant solvent system, will be performed. Studies of metal ions deposited at underpotential will be emphasized with focus on understanding the chemical shift of the species versus the corresponding bulk species. The results will be tested against a proposed theory explaining the phenomenon. Solid electrodes will be investigated with ESCA for designing an electrochemical system compatible with ultra-high vacuum conditions. Evaluation will be made of new electrode systems prepared by bombardment of metals, alloys, and metal oxides with various kinds of high-energy radiation. ESCA will be used to follow changes in the resulting surface chemistry.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0009, MODELING AND MODIFICATION OF THE ELECTROMAGNETIC PROPERTIES OF ADVANCED COMPOSITE MATERIALS

W. Gajda, University of Notre Dame, School of Engineering, Dept. of Electrical Engin, *Notre Dame, Indiana* 46556 (DF050250; AFOSR-77-3453)

AF function - recent increased use of composite materials in AF systems has required knowledge of the electrical properties of such materials. The vulnerability of the aircraft with composite components to nuclear EMP is of importance. The vulnerability is determined, in fact, by the conductivity of the composite materials. Opportunity - this research will provide basic information useful in assessing the survivability of AF systems with composite components. Objective - the objective of this study is to understand the nature of selected advance composite materials and to subsequently develop materials with desired properties. Contribution - this research will contribute to the basic knowledge of the properties of composite materials.

This investigation will approach the goal of modifying the electrical properties of advanced composite materials by - (1) developing doping techniques to increase the conductivity of fibers used in composite materials, and (2) formulating models based upon statistical theory of random media to allow prediction of conductivity and permittivity of fiber-reinforced material.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0010, RESEARCH ON CORROSION FATIGUE OF AIRCRAFT STRUCTURAL MATERIALS

D.W. Hoeppner, University of Missouri, Columbia Campus, School of Engineering, Dept. of Mechanical & Aerospace Engineering, *103 Engineering, Columbia, Missouri* 65201 (DF046650; AFOSR-77-3178)

AF function - Air Force flight vehicles are fabricated of complex, mixed materials that each exhibit different reactions to environmental effects. In order to improve the serviceability of Air Force vehicles, research should now be done to better understand the role of selected environs during the phenomenalistic problem of corrosion fatigue. Opportunity - the combined effects of corrosion and fatigue on the loss of ductility and stiffness for aerospace aluminum alloys is of real concern to airplane designers for the long term. Research in this area would provide much-needed answers for questions vital to life cycle problems of aerospace structures. Objective - this proposed effort will elucidate mechanisms of corrosion fatigue and lend insight into the corrosion fatigue phenomena that heretofore have not been available. Application of this information to materials engineering criteria, as well as fatigue life analyses, will aid in improving safety, reliability, maintainability and structural integrity of aircraft. How work contributes - this research would contribute to the AFOSR mission in the area of a continuing effort on problems relating to fatigue and fracture of metals in the field of structural materials mechanics.

Experimentally, this program will evaluate the effect of environment, R ratio, frequency, wave form and periodic overload for two aluminum alloys, 2024-T851 and 2124-T3. Analytically, the data will be modeled to approaches for prevention, prediction and alleviation of corrosion fatigue.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0011, THERMAL STABILITY OF HYDROCARBON FUELS

C.J. Nowack, U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center, Fuels Lubes & Power Dr Sys Gp, *Trenton, New Jersey* 08628 (DN889801)

To determine the relationship between fuel properties and thermal stability of synthetic and petroleum jet fuels.

Perform thermal degradation tests of fuel samples with controlled chemical composition using the jet fuel specification test procedure as well as actual aircraft hardware. Correlate the stability of the fuels with the chemical composition.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Material Command

3.0012, IMPROVED MOISTURE RESISTANCE OF FIBER-REINFORCED PLASTICS 14740-MS

J.L. Koenig, Case Western Reserve University, School of Engineering, Dept. of Macromolecular Science, *University Cir., Cleveland, Ohio* 44106 (DA0F9264; DAAG29-78-G-0148)

To study the chemical reactions induced by water vapor at the interfaces in fiber-reinforced plastic composites, and to relate these results to mechanical performance of the composites. Relevance - the research is relevant to the environmental deterioration of epoxy matrix composites which are used in Army aircraft, missiles, and packaging for shipping of material. This deterioration is reportedly the number one materials problem for army aircraft.

Study moisture attack on the untreated surface of glass fibers using vibrational spectroscopy. Study the reactions of coupling agents with glass surfaces to determine optimum conditions for coupling. Study the chemical changes caused by the presence of moisture in the coupling agent, glass surface, and adjacent matrix. Measure the mechanical properties of the composite in various stages of exposure to moisture.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0013, CONTINUOUS FIBER-REINFORCED THERMOPLASTIC COMPOSITE MATERIALS

Unknown, Boeing Co., *P.O. Box 16858, Philadelphia, Pennsylvania* 19142 (DA0G4791)

The use of continuous fiber-reinforced thermoplastic (CFRTP) composite materials is currently being accepted by the aerospace industry for application in secondary structures. These CFRTP materials are easily formed by conventional thermoforming equipment. Past work performed by Boeing on polysulfone-based CFRTP materials have indicated a decrease in mechanical strength as a result of the thermoforming process as well as a solvent resistance problem. The objective is twofold: (1) to characterize the effect of thermoforming processing condition on the mechanical properties of polysulfone-based CFRTP materials and 2) to determine the effect of real life solvent testing on the mechanical properties of polysulfone-based CFRTP materials.

Panels of devlar/polysulfone and devlar/PKXA will be fabricated and thermoformed under various processing conditions. Test specimens will be obtained and evaluated for their mechanical properties. Sandwich structures of kevlar/polysulfone and kevlar/PKXA will also be fabricated and subjected to different solvent conditions typical of aircraft cleaning solutions. Specimens will be tested and evaluated.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

3.0014, SURFACE REINFORCEMENT OF GAS TURBINE COMPONENTS BY REFRACTOR COATINGS DEPOSITED BY MEANS OF VACUUM PYROLYSIS

S.R. Brown, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN881212)

Utilize vacuum pyrolysis techniques to develop wear, oxidation and sulfidation-resistant coatings for advanced aircraft propulsion system components, including hot pressed ceramic and super alloy hot section components.

The advantages of vacuum pyrolytic techniques will be exploited to impregnate and coat thin-walled and holed structures with novel refractory materials.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

3.0015, FAST OPTICAL SWITCHING IN NARROW-GAP SEMICONDUCTING MATERIALS

A.V. Nurmikko, Brown University, Graduate School, Dept. of Engineering, *University Hall, Box 1883, Providence, Rhode Island* 02912 (DF046910; AFOSR-77-3199)

AF function - secure space communications and covert optical electronics require devices which exploit special properties and interactions of materials with far infrared radiation. Opportunity -infrared materials research has a high potential impact on novel detectors, sources and communications for airborne and spaceborne applications. Objective - this research investigates the optical interactions between infrared radiation and solid-state materials, for the purpose of utilizing the special properties of enhanced transmittances or reflectances induced by optically excited degenerate electron-hole plasmas in such alloys as (Hg,Cd)Te and(Pb,Sn)Te narrow-gap semiconductors. How work contributes - such unique properties could provide suitable materials for fast optical switches, modulators and gates for picosecond infrared pulsed transients and for integrated microcircuity in infrared planar waveguides, optical communications and signal processing.

Suitable optical quality over a wide range of alloy compositions is being sought in narrow band-gap semiconducting materials with controlled composition, homogeneity and doping. The radiative and non-radiative recombination processes and diffusion dynamics which occur at high excess carrier densities are being studied to provide basic understanding of the dynamics of the electron-hole plasmas in these semiconductors. Of particular interest is the coupling of a degenerate carrier gas to phonons and plasma waves in the materials. Experimental methods consist of ultrashort laser pulse techniques aimed at extending fast time-resolved measurements to the picosecond time scale.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0016, CHARGE TRANSPORT MODES IN NICKEL HYDROXIDE ELECTRODES

J.T. Maloy, West Virginia University, School of Arts & Sciences, Dept. of Chemistry, *Morgantown, West Virginia* 26506 (DF043440; AFOSR-76-2987)

AF function - flight operations and communications depend on auxiliary battery sources for power. Deficiency - extreme temperatures, longer life, lighter weight, and higher energy batteries are needed to meet Air Force requirements. Objective - various electrochemical techniques will be used to characterize electrode behavior in various electrolyte systems, and to develop a mathematical model of the charge transport processes involving the electrodes being studied. How work contributes - results of this research will give information about electrode performance at temperature extremes, and the data will be useful in designing cells that can yield a maximum charge-discharge cycle.

Cyclic voltammetry, chronoamperometry, and double potential step chronocoulometry will be used to characterize electrode behavior as a function of cobalt hydroxide concentration in the nickel hydroxide film covering the electrodes. To attack the charge transport problem in thin-film Ni(OH)2 electrodes a theoretical model will be developed within the appropriate modification of existing computer programs to handle the boundary conditions required in electrodes of the type being studied. This sort of model would be useful in predicting the lifetime of a given electrode subjected to repeated charge-discharge cycles.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, HOLOGRAPHIC LENSES FOR MISSILE GUIDANCE

B.D. Guenther, U.S. Dept. of Defense, Army, Missile Research & Development Command, Technology Lab., *Redstone Arsenal, Huntsville, Alabama* 35809 (DA0F1397)

To evaluate holographic lens technology for missile guidance application.

Construct a step zoom lens demonstration operating at 632.8 mm followed by the design and construction of a zoom lens that would demonstrate the ability to perform a beam rider-type mission. Evaluate the performance of a corrector plate that would allow a missile to use a high-performance aerodynamic profile without hampering the electro-optical subsystem.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Technology Lab.

4.0002, FEASIBILITY STUDY FOR A LOW-COST RAM-JET FUEL CONTROL

D.J. Schaffer, Signal Companies Inc., Airesearch Manufacturing Co, *402 S. 36th St., Phoenix, Arizona* 85034 (DN890121; N00019-78-C-0413)

Conduct a research project to prove feasibility of a fluidic fuel control concept which can be applied to an advanced ram-jet engine.

The approach is to define the control system and its component parts and determine the critical interfaces with the proposed ram-jet and the vehicle. A preliminary layout of the control system to include all sensor inputs will be made and the critical items will be fabricated and bench tested to cover the predicted operation parameters in order to prove operational capability of the fuel control.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0003, CHEMICAL REACTIONS IN TURBULENT MIXING

H.W. Liepmann, California Inst. of Technology, Graduate School, Dept. of Engineering & Applied Science, *1201 E. California Blvd., Pasadena, California* 91109 (DF042810; F44620-76-C-0046)

AF function - weaponry, airbreathing propulsion, aerospace vehicles. Deficiency - with the present state-of-the-art it is not possible to predict, a priori and with any confidence, the progress of a reaction in turbulent flow. This lack of understanding of reactions in turbulent flow makes it difficult to optimize the design of the reaction sections of gas lasers and turbine engines and thus increase the system efficiency. Objective - to accelerate the acquisition of the needed understanding of this turbulent chemical reaction problem. How work contributes - increased understanding of the interaction of energetic chemical reactions and turbulent gas flows will assist practical design of combustion components of a number of devices.

In this effort a team of the country's best experimentalists in turbulent fluid flow and a top flight theoretician will explore the consequences of a new physical picture of the turbulent flow process deriving from the work of the principal investigator and his associates which revealed an organized eddy motion in turbulent shear layers. Experimental parameters are to be varied over a wide range.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0004, THERMAL BLAST DAMAGE TO EQUIPMENT, PREFERRED DATA BASE - ENERGY INVESTIGATION

W. Chan, General Electric Co., *735 State St., Santa Barbara, California* 93101 (DA0P4526; DAAR11 77 C 0110)

A) To develop a preferred data base for nuclear and He blast damage to communications equipment. B) To develop a prepared data base for nuclear blast and thermal radiation on aircraft and aircraft structures. C) To study the energy in the blast wave of dipole west shot II.

A) Conduct a literature search, collate, and assimilate information which is available on Army communication equipment exposed to blast. B) Conduct a literature search, collate, and assimilate information which is available on aircraft and aircraft structures which have been exposed to a pressure up to 12 kpa and a thermal level up to a 10 cal/sq. cm. C) Calculate the energy within the primary blast from the lower charge of dipole II and determine the variaton of the energy with time and its distribution within the waves.

SUPPORTED BY U.S. Dept. of Defense, Armament Research & Development Command, Ballistic Research Lab.

4.0005, LOW LIFE CYCLE COST COOLER FOR AIR LAUNCHED MISSILES

S.E. Spencer, Hughes Aircraft Co., *Centinela Ave. & Teale St., Culver City, California* 90230 (DF137070; F33615-76-C-3096)

The problem to be solved by this effort is one of logistics and finite operational life of sidewinder-type infrared air-to-air missiles. Present air-to-air missiles use open cycle J-T cooling or thermoelectric cooling. The J-T cooler has a finite operational life because of high-pressure gas storage limitations and high logistics costs because of the need for very clean high-pressure gas at remote operational sites. The thermoelectric coolers can not provide temperatures low enough for the desired sensitivity of IR guidance devices. The objective of this effort is to develop a low life cycle cost, closed-cycle cryogenic cooler for sidewinder-type infrared air-to-air missiles. A closed-cycle cooler can be operated for long periods of time and eliminates the logistics problem of providing clean, dry nitrogen at remote operational sites.

A split system, low life cycle cost, closed-cycle cooler will be developed and configured for the AIM 9l sidewinder missile. The cooler and its supporting electronics will be subjected to extensive environment, performance and life tests and then transitioned into Air Force air-to-air missiles.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0006, TEAL RUBY SIMULATION STUDY

E. Winter, International Business Machines Corp., Federal Systems Division, *2675 Towngate Rd., Westlake Village, Thousand Oaks, California* 91361 (DF368238; F04701-77-C-0172)

The study will evaluate data processing concepts through simulation in determining the feasibility of detection of aircraft from space using step/stare mosaic focal planes in support of the teal ruby program. Contract F04701-77-C-0107.

The study will identify applicable background phenomenology, sensor and target models; select and define candidate target identification/track algorithms; upgrade the multi-optical sensor simulation II (MOSS-II) system; evaluate candidate algorithms to determine performance sensitivity and risk areas which would impact development of an operational system.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Space & Missile Systems Org.

4.0007, COMMUNICATIONS - PLASMA INTERACTION EXPERIMENTS AT SYNCHRONOUS ALTITUDE

J.B. Reagan, Lockheed Missiles & Space Co. Inc., Research Laboratory, *3251 Hanover St., Palo Alto, California* 94304 (DN675180; N00014-76-C-0444)

Energetic charged particles in the earth's magnetosphere cause potentially damaging voltages to build up on spacecraft such as the planned Navy fleet SATCOM, and when precipitated into the ionosphere disrupt naval communications, navigation, and radar systems performance. The objective of this research is to study the origin, injection, acceleration, and transport of these particles, together with their interactions with electromagnetic waves. This will lead to an understanding of the spacecraft charg-

ing phenomenon, and also to wave particle interactions, which could lead to a new communication mode by controlled modulation of particle precipitation.

Three sets of experimental equipment are being designed and fabricated for launch on the P78-2 (SCATHA) satellite, whose primary mission is the study of spacecraft charging: a light ion mass spectrometer to measure the density, temperature, composition, and plasma flow characteristics of the ambient cold plasma; an energetic ion mass spectrometer to measure ion fluxes, composition, energy spectra and pitch angle distribution of the epithermal plasma; and a high-energy particle spectrometer to measure the flux, spectra, and pitch angle distribution of energetic electrons, and of protons and alpha particles during solar particle events.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0008, NAVY VEHICLE DESIGN AND CONSTRUCTION - STRAKE AERODYNAMIC DESIGN

S.B. Spangler, Nielsen Engineering & Research Inc., *850 Maude Ave., Mountain View, California* 94040 (DN875420; N00014-78-C-0388)

The use of strakes, or leading-edge extensions, on recent fighter-type aircraft, has been shown to improve greatly the high angle-of-attack aerodynamic characteristics of these aircraft. The beneficial effects stem from the formation of leading-edge separation vortices on the highly swept strake and the subsequent interaction of these vortices with the flow over the wing to produce significant lift on the wing-strake to considerably higher angles of attack than is the case for the wing alone. These benefits have been derived primarily by cut-and-try methods in wind tunnel tests. The understanding of the fundamental fluid flow phenomena necessary to do a priori design of strake-wing-body combinations does not exist. The objective of this investigation is to develop the capability to do systematic practical strake design at the aircraft preliminary design phase.

A coordinates experimental-theoretical program is proposed to develop methods for describing the flow over a highly swept strake/body combination with rounded strake leading edges. Preliminary water tunnel and wind tunnel tests will be conducted. These data will provide sufficient initial understanding to develop an analytical preliminary design model.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0009, PRACTICAL CONTROL ALGORITHMS FOR NONLINEAR STOCHASTIC SYSTEMS AND INVESTIGATIONS OF NONLINEAR FILTERS

D.L. Alspach, Orincon Corp., *P.O. Box 22113, San Diego, California* 92122 (DF040520; F44620-75-C-0023)

AF function - design of Air Force aircraft control systems. Deficiency - uncertainties in the control system input along with the inaccuracies of the sensors used to measure performance caused degraded system performance. Objective - the objective of this research program is to develop better methods for handling systems where uncertainties result in significantly degraded performance. How work contributes -this research could produce practically implementable algorithms for controlling Air Force systems more accurately and efficiently.

The approach here is to map out those types and classes of control systems where an optimal or good nonlinear estimator together with a deterministic control law can give improved system performance. Almost all dynamic systems of engineering interest that must be controlled are designed such that enough measurement information is or can be made available to estimate the state of the system at all times with a high degree of accuracy. The data processing required to combine data from many sensors and processes to obtain accurate state estimators may be outside of the ability of linearized filter algorithms or even infeasible. However, the system does not have to be driven to some particular part of state space in order to make it inherently observable. It is just for practical systems such as this where it is expected that certainty equivalence controls work well. The idea of modelling certain real world dispersive systems as systems with multiple linear systems, each with an unknown time delay and unknown time compression, will be investigated. If these parameters can be identified, then the use of more conventional control algorithms in series with this nonlinear filter that does the identification will be attempted.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0010, AURORAL-REGION DYNAMICS DETERMINED WITH THE CHATANIKA RADAR

V.B. Wickwar, S R I International, *300 Ravenswood Ave., Menlo Park, California* 94025 (DF050570; F49620-78-C-0018)

AF function - the high-latitude ionosphere impacts upon numerous Air Force missions. Samso, ESD, and AWS all have stated needs for modeling of the ionosphere. Deficiency - the time/space scale of rocket probes has permitted little understanding of the neutral dynamics of the ionosphere. Yet these winds transport energy and chemistry, and interact directly with the plasma. Objective - to determine the altitude and time dependence of the quasi steady state e and f region neutral winds, to investigate the correlation between dynamical and precipitating particle effects and the departure of neutral winds from their quiet-time value, and to investigate the use of the radar to investigate gravity waves. Contributions - to better understand the neutral dynamics contribution to the energetics of the northern latitude ionosphere.

Archived Chartanika incoherent scatter radar data will be analyzed to determine neutral winds in the e and f regions. Case studies when ion drag, joule and particle heating data are available will be correlated with the neutral wind perturbations to better understand the energetics and dynamics of the high-latitude ionosphere.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0011, CLUSTER VARIATION STUDY OF COHERENT ORDERING IN FCC AND BCC SOLUTIONS 14071-MS

D. Defontaine, University of California, Los Angeles Campus, School of Engineering & Applied Science, Dept. of Engineering, *405 Hilgard Ave., Los Angeles, California* 90024 (DA0E9281; DAAG29-78-G-0058)

To apply the cluster variation method to a number of heretofore intractable theoretical problems in the field of coherent order-disorder reactions in bcc and fcc lattices. The research is relevant to Army programs in alloy development, heat treatment of alloys, phase transformations in alloys. As such the research is relevant to problems in development of a whole spectrum of new materials (e.g. clustering in the new amorphous magnetic alloys which may be exployed in shielding), as well as the solution of a large number of problems with existing materials (e.g. ordering in commercial nickel-based super alloys such as hastelloy B, which are employed in aircraft engines).

The program will include (1) computation of coherent ordering phase diagrams, (2) computation of long-range order parameters in the investigated alloy system as a function of temperature, and (3) computation of short-range order parameters (cluster probabilities) in the investigated alloy systems and comparison with X-ray and neutron diffraction data.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0012, DIGITAL FILTERS AND INTEGRAL APPROXIMATION THEORY

L.O. Ferguson, University of California, Riverside Campus, School of Natural & Agricultural Sciences, Dept. of Applied Science, *Riverside, California* 92502 (DF052230; AFOSR-78-3599)

AF function - to advance the design of cost-effective digital filters for radar, telemetry, and communications systems. Deficiency -the advantages of digital signal processing are so compelling that the AF as well as commercial communications companies is gradually converting all communications to digital systems. The applications, however, still contain some technological and economic problems that prevent the widespread usage of

digital methods. Objective - to advance the theory of approximation of rational functions with rational or integer coefficients in order to effectively design realizable filters that closely approximate a desired ideal performance. How work contributes - success in this research could lead to vastly improved digital circuitry for the various electronic systems used in aerospace vehicles and communications networks.

The plan is to apply where possible the results on approximation by polynomials and rational functions with integral coefficients to the present problem of approximating a desired transfer function by rational functions with quantized coefficients, and to extend these results where necessary.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0013, MULTICOMPONENT OXIDE SYSTEMS FOR CORROSION PROTECTION

W.H. Steier, University of Southern California, School of Engineering, Dept. of Electrical Engin, *3551 University Ave., Los Angeles, California* 90007 (DF048800; AFOSR-77-3334)

AF function - Air Force systems, particularly aircraft, are subjected to a variety of corrosive environmental conditions during their operating lifetimes. To increase reliability and reduce operating costs, improved protective coatings must be developed to minimize corrosion damage. Deficiency - corrosion damage to high-dollar-value equipment costs the Air Force an estimated 250 million dollars per year. Objective - to use a unique approach to the problem of corrosion protection for aircraft aluminum surfaces and to develop and characterize new multicomponent oxide coatings using criteria based on a conceptual model. How work contributes - substantial cost savings to the Air Force will result from improved anticorrosion coatings.

Evaluate the corrosion properties of aluminum oxide/chromium oxide, develop techniques for deposition of multicomponent oxide films, characterize these films by Auger and XPS analysis and evaluate their corrosion resistance.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0014, DISCRETE HOLE FILM COOLING ANALYSIS

H. McDonald, Scientific Research Associates Inc., *Glastonbury, Connecticut* 06033 (DF051580; F49620-78-C-0038)

AF function - advanced turbomachinery. Opportunity - improvement of present methods for predicting heat transfer and aerodynamic losses on cooled gas turbine blades. Objective - develop method for predicting the flow field resulting from the injection of an infinite row of jets through a flat plate into a cross flowing stream. How work contributes -would provide a theoretical method for screening of many proposed turbine blade cooling configurations without experimental testing which would result in better engine designs.

The investigation would be broken down into two parts. In the first part, a suitable coordinate system for the flow field would be incorporated into an existing 3-D viscous flow method and the laminar jet-cross flow problem solved. In the second part, a turbulence model would be added and several test cases run and compared with existing experimental data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0015, CRITICAL REVIEW OF RECENT RUSSIAN SCIENTIFIC LITERATURE ON FLOW SEPARATION

P.K. Chang, Catholic University of America, School of Engineering & Architecture, Dept. of Civil & Mechanical Engineering, *620 Michigan Ave. N.E., Washington, District of Columbia* 20017 (DF052660; AFOSR-78-3636)

AF function - advanced aerospace vehicles. Deficiency - lack of basic knowledge about various aspects of flow separation on general flight vehicle configurations across the speed regime. Objective - to evaluate recent Russian contributions to the field of flow separation and to disseminate this information to the US scientific community. How work contributes - by evaluating the original Russian contributions in the field of flow separation in light of research underway in the west and also by providing a means to disseminate the information, this work will help advance the state of knowledge, help eliminate unnecessary duplication of effort, and provide a firmer foundation for continuing research.

A critical review will be made of the most significant of the 300 recent Russian papers referenced in 'New Results of Separated Flow Studies,' NASA TTF 117, 130, as well as two books in process of being translated, 'Gradient and Separated Flows' (1976) edited by S.S. Kutateladze and 'Gas Dynamics of Near Wake' (1976) by A.I. Shvets and I.T. Shvets. These references will be evaluated in light of approaches followed and results obtained by western researchers working in related areas.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0016, EFFECT OF COOLING AND FREE STREAM DISTURBANCES ON BOUNDARY LAYER TRANSITION IN A WIND TUNNEL

P.S. Klebanoff, U.S. Dept. of Commerce, National Bureau of Standards, Mechanics Div., *14th & Constitution Ave. N.W., Washington, District of Columbia* 20234 (DN775187; N00014-77-F-0017)

This task contributes to the solution of the problem of designing low-drag bodies for various naval applications (e.g., torpedoes, unmanned surveillance vehicles). The objective is to determine environmental effects and heat transfer effects on boundary layer transition.

Contractor will conduct experiments in the NBS low-turbulence dual test section wind tunnel. Boundary layer stability and transition will be systematically studied on a body of revolution to determine effects of various surface cooling techniques (akin to surface heating in water) and effects of controlled free stream turbulence.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0017, DABS DATA LINK EXPERIMENTS

Unknown, U.S. Dept. of Defense, Air Force, *Washington, District of Columbia* 20330 (FA78WAI-895; FA161286 (TRAIS NO.))

Provide engineering services required to develop hardware/software and the interfaces necessary to perform exploratory research on the use of the Discrete Address Beacon System (DABS) data link for disseminating aviation related messages.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

4.0018, SUPERCRITICAL AIRFOIL FOR AXIAL FLOW COMPRESSORS

Unknown, United Technologies Corp., Pratt & Whitney Aircraft Group, *P.O. Box 2691, West Palm Beach, Florida* 33402 (DN890034; N00019-77-C-0546)

Conduct an investigation on supercritical airfoil for axial flow compressors.

Use the advanced transonic airfoil design procedure to design a cascade representative of a section of a transonic compressor with supercritical airfoil vanes. Procure and fabricate the supercritical airfoil cascade. Test the supercritical airfoil cascade at the DFVLR wind tunnel facilities in Port-Wahn, West Germany. Analyze test data.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0019, NAVY VEHICLE DESIGN AND CONSTRUCTION - UNSTEADY VISCOUS FLOW OVER THREE-DIMENSIONAL WINGS

J.F. Nash, Sybucon Inc., *Atlanta, Georgia* 30339 (DN875376; N00014-78-C-0351)

The performance boundaries of modern fighter aircraft extend well into the range of nonlinear aerodynamics associated with high angle-of-attack. Flow separation and vortex flow formation on wings are typical in these conditions. A significant amount of research has been done in recent years to develop computa-

tional methods to describe these types of flows. However, little has been done to include unsteady effects which can be very important for maneuvering aircraft. It is the objective of this research study to initiate the incorporation of unsteady effects in an approximate manner into viscous flow computations for flow over three-dimensional wings.

A coupled viscous boundary-layer/potential outer flow methods based on extended unsteady boundary-layer theory will be adopted. A time-dependent turbulent boundary-layer method successfully developed for two-dimensional flows will be extended to approximate 3-d solutions and coupled to a full 3-d potential flow method. This approach will be used to investigate and describe the early phase of flow reversal and leading edge vortex formation on swept wings at high angle-of-attack.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0020, SEPARATED FLOW PROBLEMS WITHIN THE TRANSONIC AND SUPERSONIC FLOW REGIMES 13510-E

W.L. Chow, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Civil Engin, *2527 Hydrosystems Lab., Urbana, Illinois* 61801 (DA0E9069; DAAG29 76 G0199)

To develop an analysis and a prediction method for the base pressure problem for both two-dimensional and axisymmetric bodies in transonic and supersonic flow regimes including possibilities for base bleed. The research is quite relevant to the understanding of flow near the base of projectiles and missiles and in obtaining drag coefficients for proposed projectile and missile shapes.

The viscous mixing recirculating flow region is analyzed by integral methods and coupled to the external inviscid flow by a dividing streamline analysis. The inviscid flow field is determined by finite difference methods.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0021, TEST PROCEDURES FOR SEMICONDUCTOR RANDOM ACCESS MEMORIES

S.M. Reddy, University of Iowa, School of Engineering, Dept. of Electrical Engin, *Jessup Hall, Iowa City, Iowa* 52240 (DF052050; AFOSR-78-3582)

AF function - to advance the design of digital avionics systems. Important functions in growing numbers are being performed by digital computers on USAF aircraft. Deficiency - the large size random access memories that are now being fabricated on a single chip are impossible to test completely and a methodology is required that will enable digital circuit engineers to test and maintain computers by using extremely efficient partial testing patterns. Objective - to design test procedures to cover individual failure modes, which would be used sequentially. These procedures are to be applicable to all random access memories. How work contributes - the results of this research, if successful, would advance the reliability of on-board computers which are essential for future aerospace vehicles.

The plan is to study the interactions between faults, analyze the fault coverage provided by given test patterns, derive bounds on the length of test patterns that detect a given class of faults, and design test patterns that are better than known test patterns that yield equal or less fault coverage.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0022, NONLINEAR MECHANICS OF UNSTABLE PLASMAS

H. Lashinsky, University of Maryland, College Park Campus, Inst. for Fluid Dynamics & Applied Mathematics, *College Park, Maryland* 20742 (DF045870; AFOSR-76-3129)

AF function - aerospace vehicles. Deficiency - oscillations of non-linear systems of technological interest include mechanical vibrations, instabilities in automatic control systems, mode-medium interaction in gas lasers, audio and radio-frequency electronic oscillators, and instabilities in plasma devices from arc-heated wind tunnels to apparatus for thermonuclear containment. Except for the latter, all of these concern the Air Force. While much is understood about these nonlinear systems, there is a lack of a sufficiently basic theoretical framework to treat the general class of all unstable nonlinear mechanisms, so that discoveries made in any one of the above categories can freely benefit the others via the basic analysis. Objective - to perform experiments with nonlinear oscillators, particularly bounded plasmas, and to interpret these experiments by analysis that is basic enough to provide understanding significant also to all oscillators describable by the same mathematical model, by the electronic oscillators, plasma heating devices, mechanical vibrators, aircraft control systems, or gas lasers. How work contributes - this work, while emphasizing non-linear aspects of plasma flows and oscillations, is conducted largely within the gap between applications of non-linear mechanics to engineering and scientific problems and the realm of pure non-linear theory. The latter is found difficult to apply by many persons faced with practical problems where it is needed. Besides the direct value of the new applications and measuring methods being found by the PI, it is anticipated that the monograph that he is completing at the end of 1978 will furnish an effective and useful reference work that will facilitate cross-fertilization of methods between the numerous disciplines having need for an understanding of non-linear oscillations and convection processes.

Theoretical and experimental analysis will continue on the stabilization of plasma drift waves by lower hybrid fields, and the possibility of using parallel electric fields or the lower-hybrid electric field for stabilization of the drift cyclotron loss-cone instability will be evaluated. The Lashinsky-cap equation, discovered and exploited previously in this work effort, describes a wide variety of non-linear growth phenomena. (Text Abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0023, PHYSICAL CHARACTERIZATION OF ELECTRONIC MATERIALS

A.S. Kulin, Manlabs Inc., *21 Erie St., Cambridge, Massachusetts* 02138 (DF904130; F19628-78-C-0060)

AF function - command, control and communication. Deficiency -present device performance reliability and lifetime are affected critically by surface and interface recombination processes. The objective is to conduct a research support effort on the characterization of specific physical, chemical and structural properties of solid-state EM materials. How research contributes - these studies will produce samples and specimens of solid-state materials which will be precisely oriented, cut and polished to RADC/ET specifications. These materials will then be used by RADC/ET personnel in their research to provide more reliable electronic devices for command, control and communication systems.

The techniques to be used will include X-ray diffraction and crystallography, electron microscopy (including scanning and transmission), electrical measurements and metallography. Typical materials to be processed will include quartz (natural and synthetic), silicon, InP and other materials of electronic importance.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0024, DETERMINATION OF EFFECTS OF AIRCRAFT PROXIMITY ON AIRDROP ITEMS

G.A. Barnard, U.S. Dept. of Defense, Army, Natick Research & Development Command, *Natick, Massachusetts* 01760 (DA0H4399)

Identify aspects and features of aircraft design which may present hazards to jumpers or airdropped cargo.

Develop computer model to quantify effects of aircraft wake on jumpers and cargo. Compile test data on aircraft wakes for input to computer model.

SUPPORTED BY U.S. Dept. of Defense, Army, Natick Research & Development Command

4.0025, THIN SEMICONDUCTING FILMS DEPOSITED BY SPUTTERING

R.J. Soukup, University of Nebraska, Lincoln Campus, School of Engineering & Technology, Dept. of Electrical Engin, *Lincoln, Nebraska* 68508 (DF046480; AFOSR-77-3155)

AF function - microwave solid-state devices are essential elements of Air Force communication, reconnaissance, surveillance, and countermeasure systems. Improved performance of devices that generate and process microwave signals can be expected from use of purer solid-state materials and sharper boundaries between these materials. Opportunity - present microwave solid-state device performance is limited by the inability to grow very thin, high-purity, low-defect, uniformly doped layers with abrupt doping levels. Thin films are currently produced by several methods such as liquid phase epitaxy (LPE), chemical vapor deposition (CVD), and sputtering, each having advantages and disadvantages. Objective - the objective of this research is to improve the sputtering technique for doped compound semiconductor thin films. How work contributes - this research will add to the body of knowledge required for the determination of the potential of the sputtering technique in comparison with other methods of producing doped semiconductor thin films.

A compound semiconductor such as GaAs will be sputtered while co-sputtering a constituent of the compound to maintain stoichiometry and/or co-sputtering an impurity dopant. The electrical and transport properties of the sputtered film will be determined.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0026, FURTHER DEVELOPMENT OF A SINGLE GLAZE PLASTIC TUBE LIQUID FLAT PLATE COLLECTOR

J. Armstrong, Calmac Manufacturing Corp., *150 S. Van Brunt St., P.O. Box 710, Englewood, New Jersey* 07631 (NAS8-32253)

Calmac Manufacturing Corporation will design, develop, test and deliver the Sunmat liquid flat-plate collector. This collector uses insulation as the collector structure, plastic heat collecting tubes, two copper headers on one end of the collector and variable length with a width of 4 feet. Marshall Space Flight Center will monitor equipment progress. (DOE/CS-0010)

SUPPORTED BY U.S. Dept. of Energy, Office of Conservation & Solar Applications, Div. of Solar Applications

4.0027, WIND TUNNEL WALL INTERFERENCE

E.H. Dowell, Princeton University, School of Engineering & Applied Sciences, Dept. of Aerospace & Mechanical Engineering, *Box 430, Princeton, New Jersey* 08540 (DF048590; AFOSR-77-3337)

AF function - advanced aerospace vehicles. Deficiency - with the trend towards larger and/or higher performance transonic vehicles, engineering design will have to be reduced to a more rigorous science than is now possible with the present state of knowledge or simulation of transonic flow. Of prime importance for the future will be the ability of the scientist and engineer to obtain model data of unprecedented accuracy in transonic tunnels, thereby minimizing the costly consequences of costly errors in scaling model results to full-scale flight conditions. One of the problems in wind tunnel testing is the magnitude of the wind tunnel wall correction that must be made, particularly for large lift coefficients and/or unsteady (time-dependent) flows. Objective - the purpose of this research is to advance the state-of-the-art in analytically modeling the fluid dynamics of the flow about and through transonic wind tunnel walls and thereby provide theoretical guidance as to the magnitude of the wall interference correction as well as to improvements that can be made with designs of new wind tunnel walls. How work contributes - the vehicle designer relies heavily on data obtained in laboratory facilities to either improve or verify his design approach. Of prime importance in using this laboratory data is a firm grip on the exact magnitude of the facility interference on the data obtained. This problem is particularly acute in transonic testing where, in current facilities, significant corrections to the data are needed to account not only for facility artifacts but also scale.

A purely theoretical study wherein an attempt will be made to develop more sophisticated theoretical models of the flow about and/or through transonic wind tunnel walls. Walls to be considered will include solid flexible, slotted and porous configurations. After developing these models theoretical estimates will be made of the interference provided by these walls for two- and three-dimensional flows, both steady and unsteady. The concept of small perturbations of the infinite atmospheric solution will be used to obtain the magnitude of the wall interference.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0028, WIND TUNNEL STUDIES OF AERO-OPTICAL INTERACTIONS

W.H. Bailey, U.S. Dept. of Defense, Air Force, Weapons Lab., *Kirtland Air Force Base, Albuquerque, New Mexico* 87117 (DF184310)

The objective of this effort is to gain an understanding of the interaction between an optical beam and an aerodynamic flow field such as exists around an aircraft. The degradation of an optical beam propagating through the atmosphere from an aircraft arises primarily from the flow field around the aircraft, up to quite long ranges. A detailed understanding of these effects is lacking. Moreover, what experimental data exists shows a lack of correlation between wind tunnel model results and measurements made in flight. This effort aims both to develop a thorough theoretical and experimental understanding of the aero-optical interaction, and to determine scaling laws between wind tunnel and in-flight results.

The approach to be taken in this effort is to first perform detailed and exhaustive studies of the aero-optical interaction using simple wind tunnel models. The aerodynamic parameter characterizing the flow around the models will be measured in detail, and correlated with the observed degradation of a laser beam propagating across the flow. The aerodynamic parameters to be investigated include the thickness of the turbulent boundary layer, the scale size of turbulence, separated and shear layer flow, oblique shock waves, and steady state (potential flow) density gradients. Optical measurements will include modulation transfer function, point spread function, intensity scintillation, angle of arrival fluctuation, and induced steady-state aberrations. The experimental efforts will be conducted as a joint air force-nasa effort at the NASA/Ames Research Center. Concurrently, theoretical studies will be undertaken to determine the scaling of the aero-optical effects between wind tunnel models, experiments, and aircraft flight experiments. The wind tunnel measurements described above will serve as input to this theoretical study. Additional experimental input and verification will come from airborne propagation experiments undertaken by the AFWL in a separate program. Finally, scale models of aircraft turrets will be investigated in wind tunnels to both verify the theoretical analyses developed and to optimize optically the turret design. The program is primarily in-house. Contractor support will be required for design and construction of wind tunnel models.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Weapons Lab.

4.0029, AIRBORNE VELOCITY SENSOR TECHNOLOGY

H.W. Wimmer, General Electric Co., Dept. of Aerospace Electronic Systems, *French Rd., Utica, New York* 13502 (DN781338; N62269-76-C-0306)

The objective of this task is to develop a full function correlation velocity sensor. This work supports work unit ZC909, agency Accession DN 681082.

A development model velocity sensor will be built to measure two dimensions of horizontal velocity, including hover, by the correlation technique. The sensor will be designed to operate over all terrains and water surface conditions.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Communication Navigation Tech Directorate

4.0030, SUPPORT OF FIBER OPTICS

D. Ruppel, Grumman Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DN896004)

Develop support concepts for fiber optics applications to avionic system.

The basic approach is to analyze the characteristics of fiber optics systems. Components and projected systems are to be evaluated for failure modes, indications of failure and degradation characteristics. Failure threshold criteria with respect to systems and components will be established. Data from development programs will be acquired and studied to correlate information relative to support requirements. The characteristics of optical fibers with respect to optical fault detection and checkout will be identified. General categories of photometric test equipment will be listed, and the general impact on support described.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0031, FUNDAMENTAL STUDIES IN OPTICAL MATERIALS

H. Posen, U.S. Dept. of Defense, Air Force, Rome Air Development Center, *Griffiss Air Force Base, Rome, New York* 13441 (DF902930)

AF function - fundamental studies and improvements in optic materials and components required for C3 applications. Deficiency - need to identify and establish the structure, properties, and potential of optical materials and components required for cost reduction, reliability, and stability of C3 systems. Objective - to study the chemistry and physics of optical materials with emphasis on thin films for integrated optics, fiber optics and nonlinear optics. How research contributes - this work is in direct support of programs underway in the electro-optical device groups of the laboratory, and in support of the LQ-10 program.

Investigations will be conducted into new techniques for surface preparation, new techniques for thin film preparation, establishment of optimum conditions for epitaxial optical film preparation, studies into techniques for strengthening and hardening of fiber optics, and other fundamental studies as required by the electro-optical device group.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0032, PULSED SUPERCONDUCTING SHAPING CIRCUIT

O.K. Mawardi, Case Western Reserve University, School of Engineering, Dept. of Electrical Science & Applied Physics, *University Cir., Cleveland, Ohio* 44106 (DF041680; AFOSR-76-2886)

AF function - the Air Force has a requirement to develop lightweight, high-power energy storage systems for a variety of applications in aircraft and space vehicles. Deficiency - present capacitive energy storage techniques do not permit the storage of large amounts of energy (greater than 10 megajoules) economically or at high energy density. Objective - the objective of this proposal is to develop a fast, repetitive pulse inductive energy storage system based upon superconducting technology. To store energy inductively simply means to store it in magnetic field. The limitations on this kind of storage are the strength of materials. The conductors carrying high current experience a repulsive force which can distort the conductors. This limitation allows energy storage at hundreds of times that available from conventional capacitive storage (energy storage in electric fields) techniques, where the limitation is dielectric breakdown strength. Contribution - this research will contribute to the development of large energy storage systems and to systems with high energy densities.

The three elements of the inductive energy storage system are an opening switch, a storage inductor, and a charging system. Superconducting technology is important to the development of both the switch and the storage inductor because superconductivity offers higher magnetic field strengths and therefore higher energy density, rapid switching capability, and low resistive losses. Mawardi's design for an inductive storage system is the inductive analogue of the Marx generator. The basic concept makes use of a number of inductors that are energized in series and discharged in parallel, multiplying the charging current by the number of inductors. Flux pumps using a matrix of superconducting wires are used to charge the inductors. This phase of the program emphasizes the output circuit for the inductive storage. These systems are normally current generators rather than voltage generators. To supply high output voltages to low impedance loads, Mawardi has developed a voltage multiplying transmission line circuit which he calls a pushnet. In this program they will design and construct a superconducting pushnet, test its performance in terms of pulse length, shape, and voltage multiplication, and continue the theoretical development to determine dependence of pulse length on various parameters.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0033, SEPARATED FLOWS ON AIRCRAFT AND MISSILE CONTROL SURFACE AT SUPERSONIC SPEEDS

O. Burggraf, Ohio State University, Columbus Campus, School of Engineering, Dept. of Aeronautical Engineering, *190 N. Oval Dr., Columbus, Ohio* 43210 (DN223002; N00014-76-C-0333)

The effectiveness of naval aircraft and missile control surfaces at supersonic speeds can be, in general, increased by minimizing the effects of flow separation. Such separation is caused by the adverse pressure gradients induced, for example, by deflected flaps. This research will be a combined numerical-analytical effort to clarify the essential physical processes in separated and reattaching flows.

Flow separation and reattachment on surfaces is an extremely complex phenomenon which can, at this time, be described only by detailed experiments or possibly numerical calculations for each specific case. In an attempt to understand better the physical processes, which are important in many more general situations, a combined analytical-numerical approach will be undertaken. The analytical approach will rely primarily on the high Reynolds number triple deck asymptotic model. Both two- and three-dimensional separation bubbles will be studied.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0034, CHARACTERIZATION OF III-V SEMICONDUCTOR DEVICE MATERIALS

R. Almassy, U.S. Dept. of Defense, Air Force, Avionics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF104050)

To completely characterize the electronic impurity and defect structure of III-V semiconductors, including selected ternary and quarternary compounds. Emphasis will be given to characterization of residual impurities, native defects, impurity dopants and concentration profiles in high-purity and doped epitaxial layers and melt-grown substrate crystals. The homogeneity of impurities and lattice imperfections as well as the electronic defect structure at surfaces and interfaces of these materials will also be investigated. A major part of the effort will be devoted to impurity and defect characterization in GaAs and InP materials required for high-frequency microwave and opto-electronic devices such as diode power sources, high-power FETS, digital processing systems, laser diodes, optical light guides and infrared detectors.

Optical, magneto-optical and other spectroscopic techniques will be employed in conjunction with carefully controlled crystal growth and doping, to characterize residual and doped concentrations of both shallow and deep donor and acceptor impurities, stoichiometric defects and the surface properties of GaAs and other III-V materials. Optical and magneto-optical spectroscopy, such as high-resolution photo-luminescence, is one of the most powerful and sensitive methods available for characterization of the electronic defect state and is relatively cheap, non-destructive and easy to apply. Spectral measurements of surface states and their effects on electronic defect structure will be assessed. Deep impurity centers and defects will be characterized by means of near infrared spectroscopy, while far infrared local mode spectroscopy will be used to resolve and identify isoelectronic as well as donor and acceptor impurities in both n and p-type layers and substrates. Spectral results will be correlated with electrical properties and with performance of microwave device structures.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0035, REAL TIME OPTICAL PROCESSING CONCEPTS
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A hybrid (optical-digital) wideband (50/70 mHz), breadboard automatic signal processor is being constructed in IN DHO-2 and will be used to demonstrate this concept to potential users. The objective of this effort is to complete the initial demonstration as planned and then to accomplish improvements, modifications, and further test and demonstration as indicated by potential user comments and our own experience.

Demonstration of the breadboard system will proceed and evaluation will occur through potential user comments and based on our own assessment and testing. Improvements and/or modifications, which might either yield more satisfactory operation or incorporate new features of interest to potential users, will be determined and implemented as appropriate.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0036, ACOUSTICS RESEARCH
R.M. Shimovetz, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF140680)

Various problems encountered in the development of AF weapon systems are related to the noise generated by the propulsion systems and pseudo-noise associated with flight through the atmosphere. These problems include degradation of the structural integrity, equipment reliability, crew health and performance, and aircraft survivability. The objective is to develop methods for the prediction and control of exterior and internal noise of military aircraft. The physical and geometric parameters of sources which are known, will be correlated to the characteristics of the noise and aeroacoustic fields and will accurately predict the spectra level, acoustic power, directivity, and correlation characteristics. These prediction methods will be in the form of design charts, computer programs, specifications, and acoustic and vibration criteria.

Existing methods of noise source estimation will be correlated into design charts and computer programs providing non-acoustician users an easily computational means of obtaining near field noise estimates of aircraft sources. Vibration and acoustic levels on the X-24B pseudo noise will present the measurements and present prediction methods for boundary layer pressure oscillations. Weapons bay cavity pressure ocillation problem studies will be extended to publishing recent work in the flight test demonstration of suppression devices and slender cavities noise prediction for the ALBM (air launched ballistic missile). VC-14 and YC-15 noise prediction efforts will include performing data and engineering analysis of the internal noise and STOL flap loads measuring programs which are contracted but may not be funded to complete the engineering analysis and report. Another area of this effort will be allocated to predicting the total radiated airframe acoustic power.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0037, DYNAMICS OF COMPLEX STRUCTURES ANALYSES AND EXPERIMENTS
J.H. Smith, Texas Tech University, School of Engineering, Dept. of Electrical Engin, *P.O. Box 4340, Lubbock, Texas* 79409 (DF047380; AFOSR-77-3231)

AF function - protection of Air Force flight systems from hostile action is an essential part of the Air Force mission. Scientifically based predictions of survivability/vulnerability for complex structures and their components is a difficult problem but one that can be solved with new and continued research. Deficiency - a scientific understanding of the failure mechanisms for complex structures does not exist and, certainly, not within the accuracy that is desired. To achieve the reliability and confidence levels necessary in designing protective structures, additional scientific studies are required to negate this deficiency. Objective - the purpose of this research effort is to provide basic information to the Air Force for use in their future predictions of survivability/vulnerability of complex structures and their components. More specifically, dynamic characteristics of damaged aircraft structures will be determined. How work contributes - results of this research will provide the Air Force with new and proven design tools for protective structures. Specifically, this work will experimentally study and develop a two-dimensional model for predicting the structural response of an aircraft stabilator under dynamic loading. The stabilator has been the chosen target of study because of handling ease, but the analytical techniques will be applicable to wing vulnerability studies.

Fundamental properties, such as resonant frequencies, mode shapes, and damping will be evaluated for varying degrees and location of damage. The ultimate goal is to predict, with reasonable accuracy, what level of damage causes a significant or serious change in structural integrity. A two-dimensional discrete element mathematical model and corresponding computer code will be developed to accomplish this and each will be verified by extensive experimental testing of a particular aircraft component furnished by Eglin AFB - a horizontal stabilator. Specifically, the approach will be biased to accomplish the following independent activities: 1) to theoretically verify a technique of transforming a wing-type surface into an equivalent flat plate. Some of this theory development has already been accomplished by earlier work for AFOSR/ADTC so this phase will primarily be to validate the theory and modify it as necessary for this new problem of a stabilator, 2) to develop a two-dimensional computer analysis code. (Text Abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0038, CONTROLLED EXCITATION OF FREE STREAM TURBULENCE
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Turbulence is an important factor in many phases of ship operation, including maneuvering, control, propulsion, and stability, and in the acoustics aspects of Navy vehicles. The results of this research should lead to better understanding of turbulence mechanisms leading to better predictions of turbulent boundary layers and consequently improved hardware design.

Improve the understanding of the physics of turbulence by conducting experiments in simple free shear flows including the following: (a) controlled excitation of a plane turbulent jet; (b) organized structure in the near field of a circular jet; and (c) effect of controlled free-stream pulsation on the structure of a plane wake.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0039, EFFECTS OF DAMAGE ON THE AEROELASTIC CHARACTERISTICS OF LIFTING SURFACES
R.O. Stearman, University of Texas, Austin Campus, School of Engineering, Dept. of Aerospace Engineering, *200 W. 21st, Austin, Texas* 78712 (DF051760; AFOSR-78-3569)

AF function - this research contributes to r.o. 4.2, aerodynamics, r.o. 4.4, aeromechanical elements, and r.o. 6.2, conventional munitions. Deficiency - the ability to predict the onset of failure and highly divergent flutter instabilities caused by damaged lifting surfaces is nonexistent. The chief difficulty lies in the aerodynamic modeling and description of the problem, as there exist no aerodynamic theory to treat lifting surfaces with damages in form of surface discontinuity. Objective - to develop methodology for the aeroelastic analysis of damaged fighter aircrafts. To relate the effects of damaged lifting surfaces to changes in aeroelastic characteristics. Contribution - this research will acquire the ability to analytically predict the aerodynamic loading on and the response of damaged lifting surfaces in flow regimes of interest.

Analytical studies will first be carried out to demonstrate that several types of critical damage to aircraft will promote destructive aeroelastic instabilities. An investigation of the different available techniques for identifying the proper unsteady aerodynamic modelling of damaged lifting surfaces will then be accomplished by a combined analytical - experimental effort. This would include a study on recently developed system identification techniques as well as extensive wind tunnel testing on

damaged lifting surfaces to provide insight into the development of analytical flow models useful in aeroelastic analyses.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0040, A MILLIMETER WAVE ATTENUATION AND DEPOLARIZATION EXPERIMENT USING THE COMSTAR AND CTS SATELLITES 14066-EL

C.W. Bostian, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Electrical Engin, *Blacksburg, Virginia* 24061 (DA0F8954; DAAG29 77 G0083)

To investigate precipitation-induced attenuation, depolarization, and differential phase shift using the CTS and COMSTAR satellites. Data obtained will be used to develop propagation path models which allow data obtained at one frequency to be scaled to other frequencies. Relevance - the Army is presently developing millimeter wave satellite systems. Results of this study will be directly relevant to the prediction of system performance parameters.

Simultaneous measurements through the same weather environment to insure identical meteorological parameters will be conducted at three frequencies. Data obtained will be analyzed to: (1) develop a statistical propagation model, and (2) develop a theoretical model with the goal of reducing the discrepancies between theoretical expectations and experimental results.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0041, HIGH-TEMPERATURE RESISTANT THERMOPLASTIC STRUCTURAL ADHESIVE SYSTEMS

J.T. Hoggath, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DN790064; N00019-77-C-0340)

Conduct an in-depth investigation under simulated service conditions, the environmental resistance and thermal stability of selected thermoplastic adhesive systems.

Expose the adhesive system to different temperatures and fluids normally used on military aircraft, determine the effect on peel strength, static creep strength and fatigue strength.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0042, FINITE ELEMENT METHODS IN FLUID DYNAMICS

N. Geffen, Tel Aviv University, Dept. of Applied Mathematics, *155 Herzl St., Tel Aviv, Israel* (DN875116; N00014-77-G-0055)

The development and rapid dissemination of accurate methods to predict the flow about naval ships, aircraft and missiles is essential for the efficient design of such systems. Through Navy participation in the support of this meeting on finite element methods for non-elliptic problems, the latest information in this rapidly changing area will become available, more immediately, for naval use.

Under joint sponsorship of the Office of Naval Research and the Air Force Office of Scientific Research, this meeting on finite element methods is being arranged to bring together at Tel-Aviv University, Israel, (25-29 July 1977) research scientists from universities, industrial laboratories and government departments for the presentation of new research results and to assess the current status and future trends of research problems in the field of finite element numerical methods for non-elliptic problems in fluid and plasma dynamics. These funds are to provide for expenses in the planning and conducting of the meeting.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0043, INVESTIGATION OF MODELLING CONCEPTS FOR PLUME AFTERBODY FLOW INTERACTIONS

S.E. Nyberg, Aeronautical Research Inst., *Box 11021, Bromma, Sweden* (DA0D9390; DAERO 78 G0028)

The technical objective of the research effort is to experimentally verify the validity of the theoretical plume-afterbody flow field interaction modeling methodology developed by Korst.

Experimental results from wind tunnel tests with jet plume flow simulated with cold air and with heated freon will be compared. The experiments will include studies of plume shape effects on base pressure, separation position and pressure distribution on conical and cylindrical afterbodies. Parameters which will be varied are free stream and jet Mach numbers, afterbody cone angle, angle of attack and jet to free stream pressure ratio.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Research & Standardization Group

4.0044, COHERENT STRUCTURES IN TURBULENT FLAMES BY LASER ANEMOMETRY

N. Chigier, University of Sheffield, *Mappin St., Sheffield, England, United Kingdom* (DF049690; AFOSR-77-3414)

AF function - advanced diagnostic techniques, advanced airbreathing engines, weapon delivery and defense. Deficiency - inability to obtain reliable measurement of important parameters in turbulent reacting flows in practical hostile combustion environment via present-day intrusive measuring and diagnostic techniques, inability to reliably evaluate combustion models. Objective - to develop more sensitive selective, precise, reliable and rapid diagnostic methods for measuring important parameters in jet engine reacting flow environment. To determine feasibility of using laser DOPPLER anemometry (LDA) for obtaining high spacial and time resolution particle size and velocity measurements in practical combustion environments, to determine capabilities and limitations of LDA as a laboratory diagnostic tool, to provide reliable experimental data to the combustion modeler. How work contributes - will provide additional understanding and reliable data to permit realistic evaluation of analytic models of complex reacting flows, will help reduce development time and cost of airbreathing propulsion systems, will permit evaluation of capabilities and limitations of various diagnostic methods, will aid in development of improved or novel new in-situ non-disturbing techniques for accurately measuring turbulent reacting flow parameters.

This study encompasses detection and measurements of coherent structures in turbulent gaseous and liquid fueled diffusion flames by sophisticated non-interference diagnostic techniques, e.g., laser anemometry, and fine wire thermocouples. Information on variation of velocity with both time and space will be obtained from a high-frequency response laser anemometer, powered by an argon ion laser and single particle counter, interfaced with a high-speed computer. Gas concentration measurements will be made by mass spectroscopy and gas phase chromatography. Growth and movement of coherent structures will be studied by high-speed movie-photography and related to direct measurement of velocity and temperature. Detailed physical mechanisms of fuel-air mixing across interfaces will be studied and related to presence of large eddies and coherent structures in the turbulent flow field. The effect of impingement of a turbulent jet flame on a cold flat plate will be studied to determine the extent to which coherence of eddy structures can be maintained after jet impingement. (Text Abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, CHEMICAL MESOSCALE AND ATP-BIOMASS CORRELATED WITH SATELLITE IMAGERY OF OCEANIC FRONTS

E.D. Traganza, U.S. Dept. of Defense, Navy, Naval Postgraduate School, *Monterey, California* (DN898087)

To investigate the formation of nutrient cells in the eastern boundary region (N. Pacific) to determine the correspondence of satellite infrared imagery to chemical mesoscale. To investigate the relationship between mesoscale distribution of dissolved inorganic nutrients and the 'microbial' ATP-biomass.

A towing and pumping system will continuously sample seawater from 10 to 50 meters. Cruises will be coordinated with satellite infrared imagery of the sea surface temperature. An expectation of this research is to obtain a better understanding of the extent to which chemical mesoscale features control the distribution of planktonic communities and energy input to the ecosystem.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Ocean Research & Development Activity

5.0002, BETA-GAUGE & XRF ANALYSIS RESEARCH AND DEVELOPMENT

J.M. Jaklevic, U.S. Dept. of Energy, Lawrence Berkeley Lab., *Berkeley, California* 94720 (D5-E681-CG; V625D-71)

OBJECTIVES: Continued development of air particulate monitoring and analysis systems.

APPROACH AND OBJECTIVES: The use of X-ray fluorescence for the automatic analysis of samples for elemental sulfur has been demonstrated. When combined with a continuous tape, aircraft-mounted sampler, it is possible to perform short-term sampling and analysis of power plant plumes. The use of the beta-particle attenuation method for total mass movement has been developed into a precise technology. A room-temperature detector for use in beta-gauge measurements has been shown to provide adequate statistics for plus or minus 2.5 microgram/sq. cm precision. Validation studies involving intercomparison with gravimetric methods are underway.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Energy Minerals & Industry

5.0003, APPLICATION OF REMOTE SENSING (LANDSAT) DATA TO COLORADO'S AGRICULTURAL REGIONS

E.L. Maxwell, Colorado State University, School of Forestry & Natural Resources, Dept. of Earth Resources, *Fort Collins, Colorado* 80523 (0072002; COL00150)

OBJECTIVE: Determine the extent to which land use and vegetation can be inventoried using LANDSAT imagery. Investigate specific agricultural applications in cooperation with the Colorado Department of Agriculture.

APPROACH: Seven and one-half minute quadrangles in Eastern Colorado or in the San Luis Valley will be selected for mapping. Existing LANDSAT imagery (from other projects) will be used unless county or state agencies purchase imagery for special applications. County agents, state foresters or Departmemt of Agriculture personnel will provide ground truth for selected areas. Specific problems such as weed infestations will be investigated if time and money permit.

PROGRESS: In cooperation with the State Forest Service, a land use map was prepared for the Brighton, Colorado, and Merino S.W. Colorado quadrangles. These maps were delivered to the State Forest Service and Adams and Washington County officials. Filtered, rectified and scaled LANDSAT data were used for these mapping efforts. In cooperation with the Colorado State Department of Agriculture (they provided money to purchase LANDSAT imagery and other materials) a 1:500,000 scale mosaic of Colorado was prepared from LANDSAT color composite images. This mosaic was photointerpreted for fourteen agricultural/vegetation land cover classes, the results of which will be digitized for use with other data to analyze state land use problems. A comparison of the Colorado mosaic (1976 images) with 1973 LANDSAT images in southeastern Colorado has demonstrated the capability for monitoring drought conditions from LANDSAT. Future efforts for drought analyses are being undertaken with supplemental funding from the State Department of Agriculture. In cooperation with the Great Plains Council Committee on Remote Sensing (GPC-7) a survey of remote sensing activities in the Great Plains was undertaken. This survey resulted in the preparation of a report.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Colorado

5.0004, GOES SATELLITE TIMING SYSTEM/P&F

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PROJECT OBJECTIVE: To develop the techniques and tools to use satellites for improved general time dissemination and for more accurate, convenient, and reliable comparisons of NBS standards and time scales with those of other national and international laboratories. A long-term goal is the replacement of present WWV/WWVH broadcasts by a satellite service.

PROJECT APPROACH: Experiments using satellites of opportunity will be conducted whenever possible and appropriate. The present experimental broadcasts of a time code from two of NOAA's GOES satellites will continue to provide a means of evaluating orbit prediction software, format content, modulation techniques, reception techniques, and user-equipment design.

SUPPORTED BY U.S. Dept. of Commerce, National Bureau of Standards

5.0005, SPACE ENVIRONMENT SERVICES CENTER

G.R. Heckman, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (8DJ3 20 80)

OBJECTIVE: Provide real time space environment services (observations and forecasts) to satisfy the national needs and those unique needs associated with national and international programs.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab.

5.0006, TROPOSPHERIC-STRATOSPHERIC INTERACTION

Unknown, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service, National Meteorological Center, *5200 Auth Rd. S.E., Washington, District of Columbia* 20023

OBJECTIVE: To investigate the vertical propagation of planetary waves from the troposphere to the stratosphere and to identify periods of significant stratospheric feedback to the troposphere.

STATUS: Harmonic analysis of planetary zonal waves 0-4 has been completed for selected periods, for geopotential heights, and for VTPR stratospheric radiances. Stratospheric warmings during these periods are being studied in a search for tropospheric and stratospheric precursors.

Plans for FY79: The stratospheric warming predictive study will be refined and completed. An appropriate NMC model will be used to examine tropospheric forecasts with and without adequate stratospheric resolution during special periods of apparent feedback.

SUPPORTED BY U.S. Dept. of Commerce, National Weather Service, National Meteorological Center

5.0007, ELECTRO OPTICS METEOROLOGY (CLIMATOLOGY)

S.G. Gathman, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN880082)

Improve the operational capability of the Navy in its function of assessing the vulnerability of certain strategic and tactical systems produced by clouds, aerosols, water vapor, and turbulence throughout the marine boundary layer by both obtaining the statistics and establishing an oceanic climatology of these parameters.

Existing experimental measurements of EOMET parameters from both the open literature, various project reports, and unpublished cruise data are assembled and edited. These data are used as input parameters to the climatology and as test standards for verification of EOMET models. As these models evolve and are proven accurate, an all-season, world ocean climatology will emerge. In cases where the absence of marine data precludes the testing and acceptance of a model, ocean cruises involving all of the EOMET parameters are undertaken.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

5.0008, ATMOSPHERIC SCIENCES, GEOPHYSICAL EFFECTS PROFILE OF ENERGETIC IONS IN THE ATMOSPHERE

R. Silberberg, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN580199)

To determine the heavy-particle radiation spectrum, especially for highly ionizing nuclei, at different levels within the upper atmosphere, and to apply the data on these penetrating particles in estimating their potential hazards to high-altitude missions.

A computer code will be developed to transport the heavy particle radiations through the magnetosphere and into the atmosphere in successive steps, until the particles come to rest or are lost through nuclear interactions. Existing data on energy spectra, composition, geomagnetic effects, energy loss, and nuclear transformations will be utilized. Experiments will be carried out to supplement the limited data that now exist on fragmentation of heavy nuclei in air. The goal of this project--the assessment of heavy-particle radiation effects--involves application of the results to an operational system, such as a high-altitude aircraft and its crew.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

5.0009, ANALYSIS OF GEOID

D.C. Brown, Duane Brown Assoc. Sys. Inc., *Drawer 550, Melbourne, Florida* 32901 (DF277900; F19628-76-C-0065)

AF function - weapon systems navigation and delivery. Deficiency -launch site, target position, and geoid uncertainties degrade accuracy of weapons delivery. Objective - analysis of geoidal form. How research contributes - provides a new means for determining geoid shape over ocean areas.

Contractor will perform first-look data analyses on satellite altimetry data collected during GEOS-C program. Data will be used to determine geoid form over ocean areas.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0010, SYSTEMATIC ANALYSIS OF ISIS 1 AND 2 LOW-ENERGY AURORAL PROTONS

J.R. Sharber, Florida Inst. of Technology, School of Science & Engineering, Dept. of Physics, *Country Club Rd., Melbourne, Florida* 32901 (ATM7715257A01)

Soft particle spectrometers on the polar orbiting satellites ISIS 1 and ISIS 2 measure the differential energy spectra of precipitating auroral electrons and protons over the energy range 10 ev to 13 kev. This grant will support a systematic analysis of approximately 2 1/2 years of ISIS proton data accumulated through 1972 which will define the variation of the proton energy spectrum, intensity, and angular distribution with geomagnetic latitude, magnetic local time, and substorm phase. Results obtained for the proton population will be compared with the better known features of the electron population. The investigation will provide a more thorough understanding of particle acceleration within the magnetosphere and over the auroral ionosphere. With its emphasis on the substorm phase, it should also provide a more complete description and understanding of the substorm process, a process which still lacks full explanation.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0011, DEVELOPMENT OF ANGULAR DEPENDENCE MODELS FOR THE NIMBUS-G ERB EXPERIMENT

S.R. Rangaswamy, Systems & Applied Sciences Corp., *6811 Kenilworth Ave., Riverdale, Maryland* 20840 (8-684; 03-8-A02-4232)

OBJECTIVE: The objective of the research effort is to provide assistance to the NOAA/NESS program for developing angular dependence models of the radiation reflected and emitted from the earth-atmosphere system for use in interpreting the Nimbus-G ERB narrow-angle observations in terms of hemispheric fluxes. These are required since the observations are made for only a few directions and the outgoing radiation is highly dependent upon direction and surface type. Also, clouds distort the angular dependence. The approach taken here is to select from past observations, a set of angular models representative of clouds, ocean, land, and ice, separately. Then, a statistical ensemble of reflected and emitted radiances will be created from the models with varying amounts of cloudiness. From this ensemble, empirical orthogonal functions (EOE) will be generated and analyzed for providing information on the classification of cloudy target areas. The principal investigator will work closely with the technical monitor to see that an efficient set of EOE is deduced to represent target categories with varying amounts of cloudiness. Results will be compared and models tuned with the Nimbus-6 ERB data set.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0012, QUO VADIS EVALUATION

D.B. Enabnit, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Ocean Survey, Sensor Development Br, *6001 Executive Blvd., Rockville, Maryland* 20852 (7-35345)

OBJECTIVE: To evaluate the Quo Vadis correlation sonar as a technique of remotely profiling currents from stationary and underway platforms.

APPROACH: This evaluation addresses the following major areas: cost, total system error, hardware implementation, status of developmental effort and scope of remaining work, and the advantages and disadvantages of the technique. The total system error analysis is being done on a contract to General Electric Co. The sources of error being analyzed for the fixed platform application are: geometric, statistical fluctuations in return signal, and non-uniform velocity distributions in the acoustic scatters. For the ship mounted installation, analyzed error sources are: pointing errors, positive uncertainty, and the error in differencing to large numbers to get a small number.

PROGRESS: The final report 'Accuracy Relationships in a Correlation Sonar System for the Remote Measurement of Water Currents' was received from General Electric. No additional effort is presently planned due to funding limitations.

SUPPORTED BY U.S. Dept. of Commerce, National Ocean Survey, Engineering Development Lab.

5.0013, STRUCTURE OF THE UPPER ATMOSPHERE

J.M. Forbes, Boston College, Chestnut Hill Campus, Graduate School, *140 Commonwealth, Chestnut Hill, Massachusetts* 02167 (DF047160; AFOSR-77-3223)

AF function - variations in neutral atmospheric structure are of importance to satellite and missile design and generation, and have important effects on communications systems. For instance, satellite ephemeris prediction, missile trajectory prediction, missile plume simulations and computer simulation of nuclear blast effects are operational problems which are affected by neutral atmosphere structure. Deficiency - in spite of progress made in the area of atmospheric physics, a sufficiently accurate model of the neutral atmosphere does not exist. Theoretical research in the area of thermospheric structure is needed to explain variations in density and composition data from recent satellite experiments which disagree in some respects with incoherent scatter data. Objective - to use the thermospheric tidal model developed during FY77 to investigate the nonlinear feedback involved in compositional separation and ozone photo-chemistry, i.e., how do the gradients in concentrations of O, N2, Ar, He and H, which are created by tidal motions, effect the atmospheric tides. Contribution -an improved model of the neutral upper atmosphere will provide a better theoretical base for predicting missile trajectories and satellite drag and will contribute to improved models of changing ionosphere and communication effects.

This work will involve using previously developed computer programs for solving the complete, coupled, inseparable momentum, continuity, and thermodynamic equations for the quite-time thermosphere, and an f-plane approximation to the full three-

dimensional model. These programs will be used to study seasonal variations in thermospheric tides, mode-coupling effects on thermospheric tides, the super-rotation mechanism, and possibly composition variations. Proposed study of the magnetically-disturbed atmosphere primarily involves development of a time-height-latitude-longitude model of the response to a localized, transient, heat source. Ion draft acceleration will also be included as a momentum source during magnetic disturbances.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

5.0014, IONOSPHERIC PLASMA TRANSPORT AT HIGH LATITUDES

M.J. Mendillo, Boston University, School of Arts & Sciences, Dept. of Physics, *881 Commonwealth Ave., Boston, Massachusetts* 02215 (DF248550; F19628-78-C-0079)

AF function - surveillance, communication, navigation. Deficiency - inadequate knowledge of plasma motions and the boundaries of trough and cusp precipitation regions as they respond to geophysical changes degrades capability of AF navigation and communications systems. Objective - development of computer codes which allows modelling of response of plasmapause, cusp and trough poleward wall to changes in geophysical conditions. Compare these theoretical results with satellite data. How research contributes - provides improved capability of forecasting shifts of ionospheric regions such as the cusp and trough region as they respond to geophysical changes. These shifts severely deviate ray paths of Air Force navigation and surveillance systems including DSCS, AF SAT COM, 414l, and their improved prediction is urgently needed.

Study and apply computational techniques to modelling of plasma dynamics for calculations of boundary and dynamical responses to geophysical changes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0015, SPACECRAFT CHARGE MODELING

L.W. Parker, Lee W. Parker Incorporated, *Concord, Massachusetts* (DF581770; F19628-78-C-0149)

AF function - space systems survivability. Deficiency - inadequate knowledge of the interaction between the energetic particle environment at synchronous orbit altitudes and the potential field of a charged satellite is detrimental to the design of future space systems. Objective - validation of present static models with geosynchronous data and the development of a time-dependent code. How research contributes -validation of present models will lead to confident application of those models to the SCATHA satellite. Development of a new time-dependent code will provide a check for AFGL's present in-house time-dependent code.

Static charging models will be validated using currently available satellite data. Analytic and numerical techniques will be utilized to develop a time-dependent code.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0016, THE SUPPORT OF RESEARCH ON THE STRUCTURE AND DYNAMICS OF MONSOON DISTURBANCES

F. Sanders, Massachusetts Inst. of Technology, School of Science, Dept. of Meterology, 77 *Massachusetts Ave., Cambridge, Massachusetts* 02139 (ATM7823799)

The objective of this research is to conduct an observational and theoretical study of the structure and dynamics of the monsoon disturbances that are observed over the Bay of Bengal during the southwesterly Asiatic summer monsoon. This study is to be carried out in three stages centered around the field phase of the Monsoon Experiment (MONEX), a regional subprogram of the Global Atmospheric Research Program (GARP) during May - August 1979. During the pre-MONEX stage, the upper air data for several southeast Asian stations and Indian stations will be examined to determine if the monsoon disturbances that appear over the Bay of Bengal propagate from further east. Daily infrared satellite data will also be examined to detect the westward propagating deep moist convective elements.

During the field phase, it is proposed to use the National Center for Atmospheric Research's (NCAR's) Electra aircraft to determine the structure of the large-scale flow and the monsoon disturbances over the Bay of Bengal.

The post-MONEX stage of the proposed research will consist of analyzing the aircraft, ship, satellite and other available station data to determine the structure of monsoon depressions during the formative stages over the ocean and mature stage over the land. It is proposed to determine the structure of momentum and heat sources during different stages of the depression's life cycle. It is also proposed to conduct theoretical studies to determine what type of hydrodynamic instability may explain the formation of these disturbances.

Bay of Bengal disturbances severely affect the health and economy of hundreds of millions of people in south Asia, yet the mechanisms responsible for their intensification are poorly understood. This research may help to improve that understanding.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0017, HIGH-ENERGY MAGNETIC ANALYZER

B.F. Sellers, Panametrics Inc., *221 Crescent St., Waltham, Massachusetts* 02154 (DF249100; F19628-77-C-0180)

AF function - navigation, communication and surveillance. Deficiency - inaccurate environmental specification for radiation hardness of microelectronic components in satellites. Objective - to study feasibility of using magnetic analysers to measure 1 to 10 mev electrons. How research contributes - direct and accurate measurement of environment will provide a data base for the design of shielding for satellite microelectronics. This will ensure suitable spacecraft lifetimes without excessive cost.

Design a flight model magnetic analyzer for the 0.1-10 mev electrons.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0018, ELECTRON DENSITY PROFILES APPLIED TO SATELLITE DETECTION/NAVIGATION

D.E. Donatelli, Regis College, Undergraduate School, *235 Wellesley St., Weston, Massachusetts* 02193 (DF247920; F19628-76-C-0255)

AF function - advanced radar and satellite navigation systems. Deficiency - the ionosphere introduces range and angle errors in the spadats tracking radars and in planned navigation systems. Objective -develop and validate models, computer algorithms and on-site specification procedures to provide real time specification of range and angle tracking errors and to provide post-event calibration of tracking and navigation systems using actual data obtained at ground-based ionospheric stations, obtained from in-situ satellite measurements and obtained from spadats radars. How research contributes - improve radar tracking and satellite navigation systems by developing algorithms and procedures to use on site measurements to update models of expected mean range and angle error.

Investigate range and angle errors of tracking radar and navigation systems. Develop relationships to use on site measurements of ionospheric parameters. Develop and validate computer algorithms for real time and post-event corrections.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0019, GRAVITY CORRELATION STUDY

M.C. Roufosse, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138 (DF580170; F19628-78-C-0003)

AF function - missile siting, targeting and delivery. Deficiency or opportunity - existing gravity imcomplete and inadequate. Objective - establish correlation between lateral inhomogeneities in earth's upper mantle and gravity anomalies. How research contributes - will provide quantitative predictors of the earth's gravity field.

Conduct qualitative and quantitative study of lateral inhomogeneities in upper mantle composition and density using ob-

served and calculated free-air anomalies topographic heights, as well as satellite altimetry, seismic velocities and heat flow values.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0020, REMOTE WIND SENSING TECHNIQUES

F.J. Brousaides, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581610)

AF function - navigation, weapons delivery, command and control. Deficiency - lack of capability to detect low-level wind shears that are hazardous to Air Force operations. Objective - to evaluate techniques for remote sensing of winds. How development contributes - development will lead to a technique for remotely measuring vertical wind shear.

An evaluation of a Lockheed laser doppler velocimeter and the AFGL acoustic Doppler wind sensor will be made. Wind data from these two remote sensors collected at the Weather Test Facility at Otis AFB will be compared with wind measurements obtained from sensors mounted on a 200-foot tower. A continual search of the literature will be made to keep abreast of new developments in remote wind sensing.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0021, INVESTIGATION OF LOW-ENERGY SIGNATURES OF GEOPHYSICAL ACTIVITY FROM SOLAR RADIO PATROL DATA

J.P. Castelli, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581050)

AF function - communications, surveillance and navigation. Deficiency - prediction of interruptions to communications, false alarms in surveillance systems from natural causes, and navigation errors due to insufficient signatures of solar-caused magnetic activity. Objective - to develop and interpret solar radio signatures of magnetic storms and elevated AP. How research contributes - provides prediction of geophysical phenomena in advance of actual occurrence.

Analysis of meter-wavelength noise storms preceding magnetic activity suggests a correlation between the two. The approach will be to relate noise storm regions with sources of recurrent magnetic activity by doing a correlation study between solar radio noise in the 100 to 300 mHz range and the geomagnetic index AP. Flux density, duration and bandwidth of noise storm activity will be addressed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0022, HIGH-ENERGY PLASMA INSTRUMENT

D.A. Hardy, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF249200)

AF function - AF satellite systems operate at synchronous altitudes where charging can occur due to natural causes and may give rise to effects deleterious to the systems. Deficiency - the data base of the high-energy plasma present at synchronous orbit is inadequate to accurately describe charging events or to properly relate them to their ultimate cause. Objective - to provide high-time resolution energetic particle sensors for the SCATHA satellite so as to permit in conjunction with other environmental and engineering experiments aboard the SCATHA satellite, the establishment of specifications which support design criteria for space systems. How research contributes - detailed data on the influx of high-energy particles will be available from this satellite and will be analyzed as a function of time, satellite charge, solar illumination and other relevant parameters.

The Magnetospheric Dynamics Branch of the Space Physics Division will provide electrostatic analyzers and solid-state spectrometers for the SCATHA satellite. These instruments will define, on a rapid time basis, the influx of high-energy particles to a geosynchronous satellite. A detailed analysis will be carried out on the data from these sensors in conjunction with data from other sensors on the satellite and other appropriate geophysical parameters.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0023, SATELLITE MEASUREMENTS OF SOLAR UV

H.E. Hinteregger, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581280)

AF function - vehicle tracking during flight and re-entry, trajectory prediction, communication systems. Deficiency - insufficient data to allow accurate modelling of the average composition and structure of the upper atmosphere and of the ionosphere, and to predict the response of the atmosphere and ionosphere to temporal variations in the solar input. Objective - determine the importance of the solar radiation within the spectral range from 140 to 1850 Angstroms in maintaining the composition and thermal structure of the upper atmosphere. Develop a set of indices characterizing the temporal variation of this solar radiation, which is the putative cause of the variations in the atmospheric composition, density and thermal structure. How research contributes - measurements of this solar radiation are made eleven times a day, at various latitudes, longitudes and solar zenith angles. The measurements are continued through many solar rotations, and are to be examined in correlative studies with other observed effects. Atmospheric composition, density and temperature are measured by analysis of the attenuation profiles of selected solar emission lines during perigee passes and at sunrise and sunset.

Specially designed grazing incidence spectrometers are mounted on a solar oriented platform on the NASA Atmosphere Explorer series of satellites. These instruments cover the spectral range from 140 to 1850 Angstroms, and each is made up of 24 individual spectrometers, multiplexed onto 12 detectors. The satellite contains an apogee motor, so that perigee passes down to 120 km can be maintained by an occasional apogee burn. The low perigee altitude allows the study of attenuation of the solar radiation in certain emission lines, from which composition, density and temperature of the upper atmosphere may be derived. Above the attenuation region, but below the energetic particle belts, unattenuated incident solar fluxes are measured. During sunrise and sunset at the satellite the occultation of the sun by the upper atmosphere allows analysis of the atmosphere remote from and below the satellite orbit. Three separate orbit orientations are used. The ae-c orbit has 65 degree inclination, ae-d (failed in January 1976) was in a polar orbit, and ae-e, overlapping the second in time, has a near equatorial orbit. Each orbit had a nominal perigee of 150 km and initial apogee of 4000 km. (Text Abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0024, BALLOON BORNE TACTICAL LORAN ANTENNA

A.O. Korn, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580630)

AF function - improve reliability of LORAN aircraft navigation systems. Deficiency or opportunity - present 400 ft. high LORAN antenna towers may become inoperative due to hostile action or severe weather. A balloon-borne antenna system would be used until a new tower is erected. objective - to design and test a simplified balloon-borne antenna system that can be erected by trained but inexperienced personnel. How research contributes - research will lead to simplified rigging and instrumentation.

A prototype 45,000 ft BJ balloon has been built and tested with a prototype antenna. In the world-wide operational mode, the balloon system will have to be erected rapidly by Air Force communications service personnel having limited experience in the use of the system. The system must therefore be kept as simple as possible. The 45,000 ft3 tethered balloon will be redesigned with an aim towards operation simplification. Balloon inflation systems, confluence point hardware, and balloon instrumentation will likewise be re-engineered so that they can be successfully handled by personnel with limited training. After the balloon antenna system has been redesigned and tested, air transportable operational units are to be procured by the SPO. In order to do this, a complete drawing and specification package will be

required so that operational systems can be procured on a fixed price contract.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0025, ASTHENOSPHERIC COUNTERFLOW - GLOBAL GRAVITY AND MANTLE EVOLUTION

C.G. Chase, University of Minnesota, Minneapolis Campus, School of Earth Sciences, Dept. of Geology, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (EAR7521622A02)

This project will continue and extend studies begun under a previous grant, 'Asthenospheric Counterflow: A Kinematic Approach.' Theoretical models of mantle motion (convection) have reached the point where any further progress must include the constraints of external observables. During the present grant period, the principal investigator will test the kinematic counterflow model against satellite gravity observations and will consider how the isotopic composition of mantle-derived volcanic rocks can be used to constrain and test models of mantle flow.

SUPPORTED BY U.S. National Science Foundation, Div. of Earth Sciences

5.0026, OBJECTIVE SCALE-DEPENDENT ANALYSES OF ELECTRA AIRCRAFT DATA FROM PROJECT DUSTORM AND GAMETAG

E.F. Danielsen, Oregon State Higher Education System, Oregon State University, School of Science, Dept. of Atmospheric Science, *126 Agricultural Hall, Corvallis, Oregon* 97331 (ATM7715240A01)

The Electra aircraft, equipped with fast responding meteorological, trace gas and aerosol sensors, made flights through three separate folded tropopause structures during the operation of Project DUSTORM, 1975. Equipped with additional sensors, the Electra will make mid-boundary layer and mid-tropospheric measurements from above the Arctic Circle to 30 degrees south of the Equator in 1977 as part of the chemical sampling program GAMETAG. These simultaneous measurements will provide new observations on the large, medium and small-scale atmospheric structures and the physical processes that form, sustain or destroy them. However, interpreting these data is complicated by perturbations caused by a broad spectrum of wave-turbulent motions. To obtain some spectral resolution, but to retain the advantanges of the time-space domain, each signal will be filtered to yield a low-freqency, slowly varying mean, and three to four decades of higher frequency deviations. The means will be combined with radiosonde data to determine the large-scale structures. The deviations will be cross-correlated to determine the heat, momentum, moisture and ozone fluxes in each frequency decade. Also, mesoscale wave theory will be used to identify wave modes. Evaluations of these scale-dependent fluxes are necessary to improve subgrid-scale parameterizations of atmospheric numerical models. In addition to the data reduction and processing described herein, this work will provide meteorological support and guidance for the GAMETAG missions. With only one north-south and one south-north traverse, representative meridional profiles must be based on sampling in representative air masses and their transition zones. With the direct line from the National Meteorological Center to the National Center for Atmospheric Research, plus isentropic and cross-section preparation and plotting programs, all of the requisite data can be prepared at NCAR. Hand analyses of these charts will make predictions of optimum flight tracks and times.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0027, THE DETERMINATION OF ATMOSPHERIC STRUCTURE FROM QUANTITATIVE SATELLITE DATA 13520

J.R. Scoggins, Texas A & M University, College Station Campus, School of Geosciences, Dept. of Meteorology, *College Station, Texas* 77843 (DA0E9002; DAAG29 76 G0078)

To determine the properties of the atmosphere from quantitative temperature and humidity, and cloud cover data provided by the Nimbus 6 satellite, and through comparisons with conventional data to determine the limitations of such data for sensing the atmosphere. Satellite meteorology in general, and this proposal specifically, has high military interest because of the possibility of observing the weather in 'silent areas' where conventional observations are not available. The data would be used in various applications including prediction of nuclear fall-out, determination of condition for Army aviation, and assessment of trafficability.

Specific analytical approaches will be devised for comparison of vertical and horizontal gradients of meteorological parameters observed by conventional radiosonde (balloon) observation (RAOBS) and by Nimbus 6 sensors. Comparison will be made for selected high, middle and low latitudes, and for differing weather events.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

5.0028, DIRECT MEASUREMENT IN SATELLITES OF IONOSPHERIC PROPERTIES

F.S. Johnson, University of Texas, Dallas Campus, Center for Space Sciences, *Richardson, Texas* 75082 (INT7808788A01)

The scientific aim of the project is to develop a program of comparative investigations within the field of ionospheric physics based on direct measurements in satellites from the East-West Satellite Series. The Central Laboratory for Space Research of the Bulgarian Academy of Sciences will utilize measurements in the Intercosmos series of satellites. The Center for Space Sciences at the University of Texas, Dallas, will utilize measurements in the Atmosphere Explorer.

The objectives of the project are twofold within the broad framework of in-situ measurement of ionospheric properties.

1. To develop realistic understanding of U.S. and Bulgarian measurement techniques and accumulated data base. 2. To exploit these data and diverse approaches of interpretation to study the interactions between the Earth's ionosphere and magnetosphere, in particular, the problem of global morphology and the nature of the transition region between O ions and the light ions H and He.

This work is in collaboration with Professor Kiril Serafimov and Dr. Ivan Kutiev of the Central Laboratory for Space Research, Sofia, Bulgaria.

SUPPORTED BY U.S. National Science Foundation, Div. of International Programs

5.0029, OPERATE GOOSE BAY IONOSPHERIC OBSERVATORY

J. Kelsey, Canadian Commercial Corp., *Ottawa, Ontario, Canada* (DF241140; F19628-76-C-0072)

AF function - communications, surveillance and navigation at high latitudes. Deficiency - the disturbances of the high latitude or arctic ionosphere frequently cripple the above functions. Existing understanding is insufficient to predict disturbances and their impact. Ionospheric/auroral models which will allow routine operation of AF systems in this environment are still marginal. How research contributes - the geophysical data base provided by the contractor and enhanced data output obtained during coordinated aircraft/ground-based experiments are the basis for research advances in the areas of scintillation studies, monitoring of the state of the high-latitude ionosphere and modelling of the bottomside ionosphere. These efforts support satellite communications and all AWS users dealing with the high-latitude ionosphere and are important to the development of techniques to support CONUS OTH B.

Contractor operation of ionospheric vertical and backscatter sounders, polarimeters, riometers and magnetometers provides the data for real-time support of AWS/GWC during night hours. These data, enhanced by data from an all-sky camera and from satellite receivers for scintillation measurements, are sent to AFGL for scientific analysis. A system for the automatic pre-analysis of geophysical data will be evaluated and improved with the goal of total automation of real time data analysis. Operation of the station is enhanced during selected periods of airborne ionospheric studies of the arctic ionosphere and auroral effects on AF systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0030, FALLOUT WINDS FROM SATELLITE RADIANCE OBSERVATIONS

G. Ohring, Tel Aviv University, Dept. of Geophysics & Planatary, *Ness Ziona, Israel* (DA0D9338; DAERO 77 G0051)

The major purpose of the proposed research program is to develop and test techniques for inferring effective fallout winds directly from mix of satellite radiance and conventional (radiosonde) observations.

The proposed technique should enable a simple, quick, direct transformation of the satellite radiance observations to effective fallout wind. The research will test and validate the technique on the sets of satellite and conventional (radiosonde) data available for White Sands Missile Range before testing the technique on field operational satellite and conventional observations.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Research & Standardization Group

5.0031, STUDY OF THE IONOSPHERE USING TRANSMISSIONS FROM RADIATING SATELLITES

O.J. Cardus, Observatorio del Ebro, *Tortosa, Spain* (DF582460; AFOSR-78-3498)

AF function - radar/navigation. Deficiency - refraction and range errors. Objective - measure and predict ionospheric parameters causing deficiencies. How research contributes - results used to develop predictive models and corrective algorithms for radar and satellite navigation systems such as GPS/NAVSTAR.

VHF signals from appropriate satellites recorded and analyzed by grantee to yield long- and short-term TEC variation. Analyses and reduced data delivered to AFGL for inclusion into AFGL-developed models and algorithms for operational commands.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, ATTENTION AND TASK COMPLEXITY AS INDICATED BY PHYSIOLOGICAL INDICES

E. Lindholm, Arizona State University, School of Liberal Arts, Dept. of Psychology, *Tempe, Arizona* 85281 (DF223350; F33615-77-C-0069)

To develop physiological measures of pilot attention and task load for use in flight simulation research studies. Ultimately these physiological measures will be used in conjunction with behavioral measures of pilot attention and task difficulty, in order to optimally structure flight simulation training programs and equipment.

Task difficulty will first be manipulated with standard information processing tasks which have reliable behavioral measures. The purpose of this phase is to determine the physiological responses which are most consistently related to behavioral responses. Later, behavioral and physiological measures will be taken with a secondary task technique combining two relatively simple information processing tasks which provide a more realistic approximation of actual aircraft flight.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0002, CONTRIBUTION OF MOTION TO TRAINING

E.L. Martin, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF222010)

1. To determine the contributions of simulator motion to the acquisition of flying skills for the purposes of identifying the most cost-effective hardware configurations for utilization of existing systems and for future procurement. 2. To develop a measurement methodology for determining the effects of motion on performance during skill acquisition.

The contact flying skill contact of the T-37 phase of UPT training has been categorized into four areas: 1. Basic contact skills, 2. takeoff/landing skills, 3. Aerobatic skills, and 4. Formation skills. A series of experiments will be conducted to determine the contributions of simulator motion to these skill areas. The development of the studies will follow a branching logic in which the most costly configurations are compared with the least costly. Intermediate configurations would be investigated in the event that the most costly were found to be significantly superior. All studies will employ a transfer of training paradigm using T-37 UPT students as subjects. The Advanced Simulator for Undergraduate Pilot Training (ASUPT) will be used for the simulator training phase of each study.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0003, EFFECTS OF POLLUTANTS ON VERTEBRATE CELLS IN VITRO

M.W. Berns, University of California, Irvine Campus, School of Biological Sciences, Dept. of Developmental & Cell Biology, *Irvine, California* 92664 (DF046230; AFOSR-77-3136)

AF function - the Air Force uses many unique chemicals and materials to obtain optimum performance for its aircraft and missiles. These chemicals and materials or their byproducts impact on the surrounding environment with varying degrees of severity on both a short- and long-term basis. Legislative and regulatory controls mandate that the Air Force is responsible for assessing and controlling pollution in its operations. Deficiency - there is a need to develop a rapid and sensitive assay system for pollutants and to elucidate the basic mechanisms of biological action of these compounds. Objective -the purpose of this research is to develop in vitro an assay system for the evaluation of various environmental pollutants while obtaining a basic understanding of some of the mechanisms of agent action at the cellular level. How research contributes - the research directly supports subarea 1.9, 'Environmental Protection and Toxicological Hazards.' Results could lead to controlled usuage of known harmful agents and development of agents that have the same operational efficiency but with minimal biological effects.

Growth studies will be conducted using MMH and UDMH on various vertebrate cells in culture including two diploid human cell cultures. Examination of sister chromatid exchanges following exposure to hydrazines will also be done. Scanning electron microscopy will be used to study alterations in cell surface caused by hydrazine compounds.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0004, RELATIONSHIP BETWEEN DIVIDED ATTENTION CAPABILITIES AND FLIGHT PERFORMANCE OF NAVAL AVIATION CANDIDATES

R.A. North, U.S. Dept. of Defense, Navy, Naval Aerospace Medical Research Lab., Aerospace Psychology Dept., *Pensacola, Florida* 32512 (DN877425)

The increase in complex flight tasks with the advent of high-performance aircraft and the increasing cost of training naval aviators has emphasized the need for improved techniques in the selection of candidates and for subsequent aircrew training assignments. Experts have agreed that abilities to manage information from several sources simultaneously, adapt quickly to changing situations, and integrate, store, combine, and compare data input in the course of performing several tasks concurrently are all attributes conducive to aviator success. The conclusions demonstrate the need to investigate the relationship between divided attention capabilities and actual performance during flight operations.

Previous research has demonstrated the relationship between divided attention performance and performance in flight training. This project would investigate the correlation between time-shar-

ing capabilities and naval aviator performance scores in primary and advanced pilot training and naval flight officer training. The basic divided attention test to be used included measurement of both single and concurrent task performance on a set of tasks developed at the University of Illinois Aviation Research Laboratory and refined under a current research effort at NAMRL. Candidates would be tested on selected tasks in separate and combined performances. Adaptive techniques will be employed in separate task performance to increase workload to the level of ability of each candidate. Concurrent performance situations would include conditions of changing priority between tasks measuring the candidate's ability to periodically reallocate his attention between tasks when one suddenly becomes more important.

SUPPORTED BY U.S. Dept. of Defense, Naval Medical Research & Development Command, National Naval Medical Center

6.0005, MALE AND FEMALE STRENGTH MEASUREMENTS RELATIVE TO AIRCRAFT CONTROL ACTIVITY

P.A. Furr, U.S. Dept. of Defense, Navy, Naval Aerospace Medical Research Lab., Medical Sciences Dept., *Pensacola, Florida* 32508 (DN777267)

The primary purpose of this study is to ascertain the maximal and durational muscular effort required by male and female pilots for manipulation of various cockpit controls. A secondary objective is to define strength requirements for various ground support functions -maintenance/aircraft handling.

Collect male and female strength data relative to the cockpit task (in-house effort by the Air Force). Develop an instrumentation system for the accumulation of aircraft control actuation forces (contract effort). Develop strength testing criteria to screen applicant for both aviation ground support jobs as well as piloting tasks (contract effort).

SUPPORTED BY U.S. Dept. of Defense, Naval Medical Research & Development Command, National Naval Medical Center

6.0006, APPLICATION OF VOICE TECHNOLOGY IN AUTOMATED SYSTEMS

R. Breaux, U.S. Dept. of Defense, Navy, Naval Training Equipment Center, Human Factors Lab., *Orlando, Florida* 32813 (DN494002)

Develop techniques for improving quality control while reducing costs of training Navy personnel to perform control activity such as ground-controlled approach (GCA), other surface-based controller tasks and certain mission control functions of naval flight officers. These jobs have in common the use of restricted, stylized speech to guide a man-machine system. This project will examine the training value of systems which incorporate advanced technologies such as: (a) machine understanding of spoken commands; (b) automated adaptive instruction; (c) advanced computer programming structures; (d) advanced training requirements analysis.

Study the conceptual and technical feasibility by developing a laboratory version of a system for training students in the precision approach radar (PAR) phase of GCA. If first stage successful, extend concept to other phases of GCA and to other controller-type training situations. When appropriate, conduct validation studies in an operational training setting.

SUPPORTED BY U.S. Dept. of Defense, Naval Training Equipment Center, Human Factors Lab.

6.0007, FEASIBILITY OF DOSIMETER FOR AMINE-BASED FUELS EXPOSURE

R. Elersick, Abcor Inc., *850 Main St., Wilmington, Massachusetts* 01887 (DF320890; F33615-77-C-0618)

Since NIOSH/OSHA standards for occupational exposure to toxic chemicals emphasize time-weighted average exposure, a device for determining such exposure to amine-based propellants is required for air Force use. Colorimetric dosimeters have been developed but they lack required sensitivity and are subject to interference. Solid sorption procedures are available, but they require air pumps to collect the sample. A simple badge-type dosimetric device, small, sensitive and interference free that can be easily read in the field or alternatively at a central laboratory is desired.

The desired approach to a dosimetric device is the application of diffusion across a semipermeable membrane. Study of appropriate membranes and diffusion parameters for hydrazine, unsymmetrical dimethyl hydrazine and monomethyl hydrazine will be undertaken, emphasizing the effects of ambient temperature, pressure, humidity and air movement. Appropriate detector materials/systems to be used behind the membrane will be selected to afford necessary sensitivity and simplicity of detection. Specificity may be controlled by the membrane, the detector or the measurement method. Several candidate devices will be fabricated for laboratory evaluation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0008, PREDICTIVE MODELS OF HUMAN VISUAL PROCESSES IN AEROSYSTEMS

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AF function - in Air Force flight operations target acquisition activities, optical countermeasures, display scanning, reconnaissance photo interpretation and other activities are critical for mission success. In all of these activities man's visual processes are of vital importance. Deficiency - research is needed to specify the visual performance characteristics of man in terms compatible with evolving, complex man-machine systems. Present models of human visual processes have limited value for enhancing human visual performance during critical Air Force missions. Objective - the principal goals of the proposed research are to (1) analyze the functional capacities of human observers to detect, discriminate and evaluate visual patterns, and (2) synthesize experimental data in terms of a mathematical model of the human visual system that is both predictive of performance and consistent with known physiological mechanisms. How research contributes - the proposed research will permit the comprehensive determination of a wide range of visual parameters, and the models for human visual processes critical to Air Force missions will be extended.

The research as planned covers three stages of development that will include both theoretical modeling and experimental analysis. The plan is hierarchical in that the experimental analysis will build upon the quantitative models developed in a previous stage and will supplement the construction of models for that stage. Experiments will be directed toward resolving questions concerning light- and dark-adaptation as well as obtaining basic data on spatial interactions. The processes of hue perception and foveal fixation and tracking will be studied, and quantitative models for color vision and eye movement control will be analyzed. An interactive computer control of an optical simulator that includes a visual display system, a device for the precise and accurate tracking of eye movements, and appropriate calibration devices will be employed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0009, QUANTIFICATION OF INFLIGHT FATIGUE

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This effort will provide a detection and assessment scheme for induced respiratory fatigue, and enable subsequent inference and prediction of systemic response. This latter provision will ensure a quantitative evaluation capability for environmental testing of life support items as well as contributing design guidelines for the same.

The contractor is required to derive a methodology for quantitating the phenomenon of fatigue with particular consideration of respiratory fatigue as it occurs in flight. Because fatigue is necessarily reported subjectively by the individual, objective physiologic measures must be accompanied by a subject reporting scheme. The combination of physiologic measurements and sensation reporting will then be summarized in a form enabling accu-

rate recognition and prediction of respiratory fatigue levels. This effort should be accomplished with the following sequence: (1) identification and evaluation of the most valuable noninvasive indicators of respiratory fatigue resulting from breathing resistances or their equivalent - in the laboratory setting inflight circumstances must be necessarily be approximated with treadmill exercise, ergometry, or equivalent, (2) development of an accurate method for subject reporting of fatigue on a timed interval basis, (3) determination of simple relationship between respiratory fatigue levels and easily measured functions such as spirometry, pneumotachography, or combined heart/lung function. Ultimately a recommendation is sought for the recognition of respiratory fatigue and its consequences via short-term noninvasive monitoring.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0010, ARCTIC ANTI-EXPOSURE PROGRAM

C. Fink, Energy Systems Corp., *111 Lock St., Nashua, New Hampshire* 03060 (DN881190; N62269-077C-0149)

To develop a system to provide aircrews operating in the antarctic with a means for anti-exposure protection in the event of ditching of a similar emergency situation. This contract supports work unit ZB104, Agency Accession No. DN681085.

A contract has been let with Energy Systems Corp. (on 25 Mar 77) for the procurement of 5 prototype DAPS (downed airman power source) systems for heating the water circulating in the liquid loop garments. After delivery of the prototypes, a subjective test and evaluation program will be conducted by the crew systems dept. Upon completion of the tests, a letter report will be issued evaluating the system.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

6.0011, IN VITRO CHEMICAL CARCINOGENESIS AND CO-CARCINOGENESIS IN HUMAN CELLS BY HYDRAZINE AND POLYNUCLEAR COMPONENTS OF JET FUEL

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AF function - the AF uses many unique chemicals to obtain optimum performance of its aircraft and missile weapon systems. National legislative and regulatory controls of the use of energetic chemicals have necessitated a step-function increase in the need to define safe exposure limits and handling practices for these chemicals concurrent with the acquisition of the weapon system. Deficiency - there is a need to investigate mechanisms and to devise methodologies to predict, detect, measure and modify pharmacological manifestations of the unique chemicals associated with U.S. AF weapon systems in order to protect personnel from health and performance degradation. Research is needed to determine and identify actual molecular mechanisms of chemical carcinogenesis. Objective - the objective of this research is to elucidate the mechanisms producing changes in cell chemistry, DNA and RNA and to correlate these with the metabolic and biochemical state of the cells following exposure to hydrazines and PNH's. How research contributes - this research contributes directly to subarea 1.9, 'Environmental Protection and Toxicological Hazards.'

Studies will examine the cytotoxic and carcinogenic potential of hydrazine and polynuclear hydrocarbons in synchronized and nonsynchronized normal human cells, investigate damage to cellular DNA by studying unscheduled repair kinetics and alterations in cellular associated RNA directed DNA polymerase activities, investigate whether the suspect carcinogens act synergistically with viruses to enhance virus transformation of human cells, investigate whether these chemicals activate endogenous RNA-C-type virus expression in human cells, determine whether these chemicals damage cellular DNA, providing additional sites for virus integration.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0012, CONDUCT AIR AND GROUND CREW NOISE STUDIES TO EXPAND/UPDATE USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK

R.W. Aorman, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF321420)

USAF aircraft and equipment operations generally produce adverse noise levels at flight crew, passenger, and ground crew locations which must be evaluated with respect to hearing risk, ear protection requirements, voice communication capabilities, facility siting problems, etc. The objective of this workunit is to expand and update the USAF Bioenvironmental Noise Data Handbook (developed under work unit 72310418) and, thereby, provide the data necessary to define these physical noise environments for use by MAJCOM/airbase bioenvironmental engineers, flight/ground safety officers, and others concerned about personnel safety and effectiveness.

The technical approach is to conduct field measurements, perform spectral analyses, and then apply Noisebank, the most advanced Omega software, and AFR 161-35 exposure limits to compute the required physical and psychoacoustic measures.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0013, BIODYNAMIC CRITERIA FOR DEVELOPMENT AND EVALUATION OF LIFE SUPPORT SYSTEMS

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The Life Support Systems Program Office of the Aeronautical Systems Division conducts a research and development program to provide an integrated assemblage of components, techniques and training required to assure aircrews and their passengers the best possible flight environments for conducting combat and peacetime Air Force missions. This effort includes provision of safe and reliable escape, descent, survival and recovery in emergency situations. The objective of this work unit is to provide aeromedical design criteria for the development and evaluation of life support systems such as emergency escape systems, personnel restraint systems, and flight helmets. Biotechnology data are applied to insure aircrew safety within the transient mechanical stresses associated with emergency flight conditions, e.g., ejection acceleration, aerodynamic deceleration, aircraft crash, etc.

Technical support is provided on specific life support systems programs in response to letter requests and memorandums of agreements submitted to the Aerospace Medical Division by the Life Support Systems Program Office. Support includes analysis of escape system designs to assure adherence with biodynamic design criteria, development of design criteria for new protective systems, assessments of current operational problems, and test and evaluation of developmental systems. The ASD helmet test facility is operated and maintained under this work unit. Technical consultation is also provided on the development of the high-technology ejection seat.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0014, NAV/BOMB NAV CREW STATION DESIGN AND PERFORMANCE ASSESSMENT

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To obtain quantitative data for a representative sample of Strategic Air Command (SAC) combat-ready crewmembers that appropriately reflect the workload imposed by the current equipment layout of the b-52G/H offensive avionics crewstation. These data will serve as the basis for relative comparisons in the evaluation of proposed changes to the crewstation. Long-range planning and study priorities are established by the strategic avionics task force and its action office is directed to pursue specific studies, such as the low life cycle avionics study (ASD/AES). As the B-52 offensive avionics system effort produces prototype design concepts, these will be tried and evaluated against the same mission scenario as used in the SACDEF baseline study. The objective is to provide a quantitative assessment of both man and machine prior to hardware development commitments.

An existing combat crewstation simulator was obtained and instrumented to detect when particular switches were set and to what position. SAC/XOBB was tasked to prepare a mission scenario that would properly assess the kinds and types of tasks the navigator and radar navigator are expected to execute in an emergency war order mission. SAC/DOTN was tasked to provide survey data on their combat-ready crews so a selective, representative sample of 24 teams could be sent TDY to participate in the study. Selected measures of operator and system performance will be monitored by computer. Radar scope photographs and video tape recordings were also used to collect supplementary data. Crews were thoroughly debriefed after the scenario was completed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0015, ACUTE FISH BIOASSAY

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To determine the water pollution potential of aircraft fuels and lubricants, missile propellants and their exhaust products, and other AF materials that if in sufficient quantity could result in significant detrimental effects on the environment. Transient physiological changes in organisms and toxic effects up to fish kills can serve as indices of potential pollution of the aquatic environment. The results of these studies will serve as a data base upon which environmental impact statements and assessments can be made as they apply to weapon systems using these chemicals especially where they may possibly enter an aquatic environment. The acute fish bioassay portion of previous work unit (AMRL-6302-04-11) was transferred to this work unit.

The approach to this effort utilizes experimental concepts developed in water pollution technology and fisheries biology. The applied conditions of these operational AF compounds and the types of test organisms to be utilized determine the methodology for experimentation. Propellant bioassays accomplished with guppies will be repeated using the fathead minnow currently and other fish species subsequently. The acute toxicity of hydrazine, UDMH, aerozine-50 and MMH, respectively, will be determined. Following the determination of acute toxic levels of these important compounds, the efficacy of various chemicals will be evaluated relative to reversing or reducing the toxicity to fish life.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0016, WORKLOAD ASSESSMENT METHODS

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The objective of this work unit is to develop prototype task batteries for assessing and predicting operator workload dictated by mission/system demands. The performance metrics produced will allow comparable quantitative measures of workload demands for a variety of crew member information processing functions essential to advanced aeronautical systems. A secondary objective is to insure that the task battery procedures, metrics, and hardware/software specifications are mutually compatible with the laboratory simulation environment as well as the development test and evaluation (DT&E)/operational test and evaluation (OT&E) environments. This effort supports AFSC development goals, TC-1, TC-2, TC-7, C3-3, RI-1, and MS-4.

Selected tasks from advanced digital information processing systems currently in conceptual or advanced development stages including DAIS, JTIDS, SDM, WMMCS, etc., will be analyzed in terms of man/computer information processing requirements. Critical problems will be identified from requirements and defined in terms of man/computer interface design for maximizing information transfer and throughput rates as determined from anticipated mission data rates. Human information processing measures and stages based on recent performance-theory developments will be analytically mapped onto the system data processing requirements. The results will be tested through experimental operator-in-the-loop part-task and mission segment simulations on the HESS. The resultant data and transfer functions will be integrated into the design of prototype task batteries for assessing workload as a function of task/equipment design and mission/system demands.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0017, TARGET ACQUISITION PRED

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The purpose of this effort is to apply the methodology, data representation techniques and combinatorial rules/models/algorithms developed under other efforts to systematically portray the combined effects of advanced sensors, control/display transfer functions, scene composition, human psychovisual capabilities and environmental parameters on target acquisition performance. The results of this work will be in direct support of the Target Acquisition Working Group (TAWG) of the Joint Technical Coordinating Group for Munitions Effectiveness (JTCG/ME). In addition this effort supports AFSC development goals TC-1, TC-4, RI-1, RI-5, and MS-4.

A literature survey of research dealing with direct visual and sensor-aided target acquisition will be accomplished including work done in project Seekval and other TAWG-supported research efforts. Imagery from advanced sensors (thermal imaging, LLLTV, etc.) will be added to a currently existent film imagery library for use in design criteria and model-validation studies. Facilities of the display laboratory will be used to perform real time, man-in-the-loop simulation studies to investigate key independent variables, e.g., sensor/display characteristics including resolving quality, signal-to-noise ratios, dynamic range, sensor field-of-view, etc. Additionally, the effects of various flight profiles and vehicle dynamics upon target acquisition performance will be determined. Performance characteristics of conceptual and advanced sensors and display media will be quantified and their effect convolved with image characteristics and human visual describing/demand functions to provide the requisite information for the development of a model of target acquisition. Mission scenarios derived from tactical planning documents will be used to determine how well the model is able to predict target acquisition performance. In addition, advanced signal/image processing and wide dynamic range recording techniques will be exploited to develop a family of subsystems for enhancing the display of sensor information including spatial filtering, color enhancement, color/stereo presentations and time compression techniques. This effort was previously documented under work unit 71841102.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0018, EFFECT OF BRAIN TISSUE OXYGEN LEVELS ON HUMAN OPERATOR PERFORMANCE

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The objective of this work unit is to describe and quantitate in human analogs, by invasive or noninvasive techniques, the impact of altered breathing gas environments on cerebral function/human operator performance. Applications of findings in this work unit include (a) validation and justification for use of noninvasive techniques in place of invasive procedures for subsequent human experimentation, and (b) data input to a cerebral oxygenation-operator performance model.

Accomplishment of the objective is dependent upon execution of various technology based experiments. (1) Studies involving cerebral oxygenation of non-human primates under g stress involves relatively short time sampling periods. The use of polarigraphic oxygen probe with rapid response time characteristics must be preceded by its evaluation against the standard mass spectrometer membrane. (2) Use of non-human primates on the DES in physiologic and performance related studies will require a DES animal platform modification to accommodate mass spectrometer analyzer and a performance display/data acquisition unit.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0019, TRANSMISSIBILITY CHARACTERISTICS OF THE PRIMATE SPINAL COLUMN

A.R. Slonim, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF324110)

To determine the extent and characteristics of transmissibility of motion up the spinal column of the rhesus monkey and baboon. This effort will examine also the nature (e.g., phase change) of the response of the anterior and posterior portions of the spinal column. These data should provide some insight into the transmissibility of vibration in the spinal column of man, with the ultimate objective of developing a model for predicting vibrational effects on both primate and human spinal columns, as well as developing criteria and protective measures for the safety of crewmen in aerospace operations.

Primates will be surgically prepared with implanted accelerometers at different locations on the spinal column and then exposed to vibrations of low frequency (below 100 Hz). A series of four experiments will be conducted over a period of one year. The first experiment will evaluate the effect of vibration on rhesus monkeys with two implanted accelerometers, one at an upper thoracic level and the other attached to the sacrum. A second series of experiments will utilize baboons instead of rhesus monkeys. The third group will add a third accelerometer on the baboon at the lower thoracic level. The latter will be on the posterior column, while the upper thoracic accelerometer will be on the anterior column. The first three series will utilize three primates each. The fourth series will utilize up to 7 baboons in which the intervertebral discs have been removed at one or more levels to gain further insight into the mechanics of transmissibility of motion through the spinal column. In all experiments, an attempt will be made to correlate the response resonances observed with various physiological variables and later with resonances predicted from mathematical models of transmissibility.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0020, IN-HOUSE RESEARCH SUPPORT

W.H. Schelker, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF227310)

The objective of this work unit is to provide a facility with the hardware and software capability to support the in-house research program of the division on a timely basis. Research studies are to be conducted in the areas of (1) skills acquisition and transfer for remote piloted vehicles tasks, (2) visual display simulation, (3) system sensor simulation, and (4) computational technology applicable to flight simulation. Results of efforts under this work unit will be used in support of directly documented programs and will not result in any publishable documents such as technical reports. Future plans calls for an increase in the size of the computer room and the addition of a second nine (9) track tape unit, a tape cleaning and storage facility, and possibly a second disk drive unit. A side stick controller may be added to the ROTS operator station.

Efforts will continue to improve and update the research facility used in carrying out in-house exploratory and advanced development programs of the division. A display system and additional computer storage will be procured to support programs on sensor simulation. A remote operators task station will be designed and fabricated to provide the capability to conduct research on remote operator tasks. Computer simulation models will be developed along with specialized equipments to support the division's research effort.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0021, RESEARCH ON COMPLEX SPINAL LOADING

G.T. Collins, University of Dayton, Graduate School, *300 College Park Ave., Dayton, Ohio* 45469 (DF323620; F33615-78-C-0506)

This effort will systematically collect information on biomechanical strength, deformation, and failure modes of normal and diseased vertebral segments excised from non-human primates and man. A mathematical model will be obtained which estimates human spinal strength based on non-human primate data. The ultimate objective is to reduce spinal injuries from ejection and other impact loads by using the knowledge gained in the design of ejection and protection systems.

The effort shall be limited as follows: (a) 220 tests on vertebral bodies at various strains and strain rates, (b)220 tests on vertebral units at various strain rates, (c) 120 tests on intervertebral disks at various strain rates, (d) 120 vibration tests on vertebral bodies at frequencies below 40 Hz, (e) using said data and other available data, human spinal strength shall be mathematically related to non-human data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0022, AEROSPACE BIOTECHNOLOGY RESEARCH SERVICES

J. Militello, University of Dayton, Graduate School, *300 College Park Ave., Dayton, Ohio* 45469 (DF317290; F33615-78-C-0501)

Many unforeseen probelms arise during the conduct of the laboratory's R&D programs which require special and immediate assistance not available except through contract arrangements. This contract effort provides whatever expertise is necessary for rapid solution in these situations. This is an extremely cost-effective method of supporting all areas of research and exploratory development of the laboratory including biodynamics, cybernetics, environmental medicine, toxicology, human engineering and performance studies as well as related support of many AF development and operational systems.

This contract provides intermittent studies, analyses, experimentation and technical services for all areas of the technical program, thereby avoiding costly delays in the laboratory's mission activities. Tasks are fully described through the contracting officer and made on a call basis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0023, BLOCK PROGRAM PERSONNEL PROTECTION AND SURVIVAL

D.N. Desimone, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN681085)

To provide solutions to aircrew personnel problems related to the scope of the subproject, by improving and expanding on the applicable technologies. In meeting the objectives, development may be in response to new requirements, or result from state-of-the-art advances which provide new approaches to problems. Proposed solutions to specific aircrew problems are developed and evaluated for feasibility and practicability. Fulfillment of these objectives may involve development of new techniques and products, or application of existing techniques and products in innovative ways.

Development efforts to meet the primary objectives include the experimental development of or search for new materials components techiques of fabrication subsystems and systems. Efforts will vary from the fundmental to the sophisticated application of the principles of science engineering and psychology. Some work is also performed on contract as reported in work unit ZB104B2.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

6.0024, APPLICATION OF SPECIALIZED STATISTICAL COMPUTER PROGRAM, ALPHAF, TO A SENSORY EVOKED RESPONSE DATA ANALYSIS SYSTEM

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AF function - Air Force operations expose personnel to a wide range of environmental stresses. Varying levels of per-

formance degradation occur as a result of such exposure. Means are needed to model and predict physiological and performance decrements which result from exposure to operational stresses. Deficiency - this study will allow measurement of sensory processing ability which will provide an index of human performance capability during military aircraft operations. It is not within the scope of this effort to develop an in-flight performance monitoring system but rather provide judgment of the feasibility of such a system. Objective - the objectives of this investigation are - (1) study of the applicability of sophisticated computer data reduction techniques in the investigation of sensory processing in humans, (2) to determine impact of new sensory data on existing USAF/SAM computer models of human performance, (3) provide a feasibility judgment for an on-board device that would monitor air crew sensory processing capability, (4) provide new information on sensory processing for follow-on research into radiation insult to the brain. How research contributes - this research supports ongoing related efforts covered under subareas 1.6 and 1.7, 'Habitable Crew Environments in AF Operations' and 'Human Operator Performance Modeling', respectively.

The computer analysis techniques to be employed are the fast Fourier transform (FFT), a specialized statistical program, ALPHAF, and the evoked response (ER) averaging techniques. They are to be applied to the analysis of human visual, auditory, and somatosensory evoked responses. ALPHAF will be used to determine any statistical differences that may exist between evoked responses as they are influenced by changes in cerebral oxygenation. The ER will be recorded for normoxic, hypoxic, and hyperoxic human test subjects at sea level pressure.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0025, CLINICAL FLIGHT MEDICINE EVALUATIONS

R.S. Dryden, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF323120)

To provide direct support to HQ USAF/SG and the surgeons of the major commands through clinical flight medicine evaluations emphasizing dynamic patient testing of aircrew members with medical findings or disorders which are a potential threat to flying safety and which preclude continued performance of flying duties to perform detailed aeromedical evaluations not elsewhere available and recommend clinical and aeromedical disposition to the referring medical authority IAW AFR 161-23, to enlarge the technical data base regarding disorders in the aircrew population which supports the research programs and other elements of project 7755.

Initial patient aeromedical evaluations will be charged against this work unit. Certain necessary and directed (AFR 161-23) re-evaluations not covered under existing protocols/work units will also be included here.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0026, THALLIUM 201 MYOCARDIAL IMAGING

J.R. Hickman, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF321730)

To develop a noninvasive method for detection of myocardial ischemia in USAF flying personnel.

Patients seen by the Aeromedical Consultation Service for evaluation of abnormal exercise tests will be injected with 2 UCI thallium 201 at maximum exercise. Statis scans will be made after an eight-minute recovery period. Scans will be interpreted for areas of ischemia. The results of the scan will be compared to results of coronary angiograms to determine whether significant coronary artery disease can be detected on scan.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0027, CREW UTILIZATION/CREW RATIOS FOR ADVANCED STRATEGIC OPERATIONS

H.M. Hughes, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF322160)

The effect of aircrew management policies on operations is complex due to the many factors involved and the complex interactions of these factors. Optimum values of aircrew manning and scheduling can be evolved through a proper mix of field studies of actual operations and laboratory/computer simulation of anticipated conditions not yet experienced. Field studies provide the necessary data base for postulated airlift operational conditions, while computer simulations significantly reduce the time and expense of field study data collection. Efforts will pay primary attention to upgrades and advanced concepts of the jet transport fleet.

Computer simulation program, developed at USAFSAM, which focuses on the aircrew aspects of airlift operations, will be used to simulate operations of the upgraded/advanced jet transport fleet. Effects of upgrades and innovations on the required manning will be explored and analyzed. When necessary to establish a unique data base, field studies will be conducted of crew fatigue and stress as measured by the SAM stress battery. Previous effort documented under 7930-10-01.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0028, WINDSCREEN EVALUATION - F-111 AND GENERIC

W.F. Provines, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF321960)

High-performance aircraft windshields designed to withstand bird impact have evolved into thick, curved, laminated new materials compositioned transparencies of large dimensions. This effort will provide optical measurements and visual performance capabilities of trained observers through a variety of segments and full-scale windshields characteristic of USAF inventory and emerging aircraft. Test results will provide scientifically based tolerance values for windshield specification writers and guidance to windshield manufacturers on realistic quality control measures.

An optical laboratory has been established. The facilities and equipment provide capability for accurate determinations of transmission, haze, deviation, distortion and multiple image production for any aircraft windshield provided for study. Visual performance testing in the Physiological Optics Laboratory is being conducted. Utilizing several F-111 windshields of known optical defects, the induced phoria effects of vertical prism disparity are being objectively and subjectively determined. A follow-on study is planned to ascertain the induced spatial warping effects (magnification) of those windshelds. Coordination with AMRL personnel engaged in related optical-visual performance studies will be maintained. Efforts previously documented under work units 7755-09-01 and 7755-09-04.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, THE EVALUATION OF TURBULENCE MODELS BY NUMERICAL SOLUTIONS OF THE NAVIER-STOKES EQUATIONS

J. Ferziger, Nielsen Engineering & Research Inc., *850 Maude Ave., Mountain View, California* 94040 (DN775080; N00014-77-C-0008)

The development of accurate models of turbulence is central to the formulation of reliable design methodologies for predicting viscous flow phenomena associated with aircraft, missiles and ships. The proposed research will utilize 'exact' solutions of the

Navier-Stokes equations to assess commonly used turbulence closure models.

In the present research, the Navier-Stokes equations will be solved, numerically, by finite difference and spectral methods to provide numerical data with which turbulence closure models can be assessed. Initially, calculations by finite-difference and by spectral methods will be compared for the case of homogeneous isotropic flow. Subsequently the spectral method will then be used to predict homogeneous nonisotropic (mean shear and strain) flows.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

7.0002, KINETIC THEORY OF GASES AND MAGNETO-FLUID DYNAMICS AND THEIR APPLICATIONS

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AF function - hardening aerospace vehicles. Opportunity - existing mathematical physics promises improved understanding of satellite environmental effects and their simulation. Objective - to address plasma stability problems in shiva, laser hardening, solar wind prediction, satellite charge oscillations, ionospheric modeling, etc. How work contributes - improved analysis of models designed to exhibit AF relevant effects may suggest methods of control.

At the borderline between particle and fluid, when charge, EM field and energy range combine to make nonlinear mathematical models necessary, a diversity of mathematical techniques is required. Examples are singular perturbation of spectra, bifurcation theory, pseudo differential operators, solitions, etc. Using these techniques, problems like the instabilities possibly limiting shiva X-ray output, solar wind modeling and laser target interactions can be addressed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0003, METHODS FOR COMPUTING THE PATTERN OF COMPRESSIBLE FLUID FLOW IN NOZZLES OR PAST BODIES

H. Kreiss, New York University, School of Arts & Sciences, Dept. of Mathematics, *421 1st Ave., New York, New York* 10012 (DF039000; F44620-74-C-0062)

AF function - the design of aerospace vehicles. Deficiency - numerical design of jet engines is quite empirical. Objective -efficient finite difference schemes for solving transonic nozzle flow. How work contributes - by faster, more robust engine design.

When the differential operators are replaced by a centered difference approximation and the resulting nonlinear system of equations solved by Newton's method using Gaussian elimination the number of Newton's iterations is unexpectedly small even if the initial guess is far off. This phenomenon will be investigated along with the possible replacement of 'Gaussian elimination' by 'iteration of first order systems' to reduce storage constraint.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0004, NUMERICAL ANALYSIS OF MUZZLE FLOW 14369-E

G. Moretti, Polytechnic Inst. of New York, Brooklyn Campus, School of Science & Engineering, Dept. of Aerospace Engineering, *333 Jay St., Brooklyn, New York* 11201 (DA0F8919; DAAG29 77 G0072)

To perform a numerical analysis and develop computational techniques for describing transient gas discharges characteristic of muzzle flows. Relevance - the investigation is directly relevant to the investigation of muzzle flows at both BRL and PA. Results of the investigation will assist in research into weapon accuracy, crew safety, firing signature, and artillery vulnerability.

Novel computational techniques are proposed which will include the use of sophisticated grids generated by conformal mapping, proper handling of all boundary conditions, second order integration schemes and fitting of all discontinuities.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

7.0005, MATHEMATICAL PROBLEMS IN FLUID DYNAMICS

C.L. Keller, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF136320)

Present design methods for aircraft and missiles have great difficulties to predict the behavior of airfoils in the transonic region. The work investigates theoretically problems of transonic aerodynamics. Sometimes special features, as the junction of sonic line and shock, are studied but most of the work is done with a view towards improving the methods for computing the whole flow pattern. The work includes the development of background knowledge, in particular partial differential equations. The investigations are directed towards improving the numerical techniques, as well as the physical understanding of the phenomena in transonic flow fields. Spinoffs of similar numerical techniques to problems in stress and strain of aircraft structures will be explored.

The problem is treated under two different points of view, namely the study of properties of the partial differential equation and of its solutions which may be the cause of computational difficulties, and the direct study of numerical approaches. In the first part the nature of the solutions of typical boundary value problems will be investigated; in the second part a specific numerical technique will be examined with a view towards determining how well it or certain variants are suited to overcome the typical obstacles encountered in transonic flows. Another effort in aerodynamics is the computation of incompressible flow over multielement airfoils by means of an integral equation method (combined with preliminary conformal mappings). A related effort in this area is the proof of the adiabatic theorem for partial differential equations in two independent variables. Integral equation methods for the solution of the elastic problem in solid mechanics will be studied and then extended to elastic plastic problems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

7.0006, DIGITAL DATCOM COMPUTER PROGRAM FOR AIRCRAFT STABILITY AND CONTROL

B.F. Niehaus, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF132910)

This work unit supports TPO 3, flight control, and major thrust GQ02B, flight control system design techniques. Rapid and inexpensive methods for predicting the aerodynamic stability and control characteristics of Air Force weapon systems are needed. The objective of this work unit is to provide improvements in the digital DATCOM computer program, which is an automated stability and control prediction tool. At its current stage of development, it is an efficient computer tool; however, improvements are needed to reduce the engineering time required to prepare input and to interpret output. The availability of these methods will lead to better aircraft designs by permitting rational trade-offs to be considered early in the design.

Digital DATCOM will be applied to various types of problems, e.g., preliminary design, correcting wind-tunnel data to obtain the effects of configuration changes, etc. The experienced gained will help identify weaknesses in the digital DATCOM program. Particular emphasis will be placed on the evaluation of the input requirements and output suited to specialized tasks, as well as method accuracy and range of applicability.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

7.0007, NUMERICAL METHODS FOR COMPRESSIBLE FLOW FIELD COMPUTATIONS

K.G. Guderley, University of Dayton, Graduate School, *300 College Park Ave., Dayton, Ohio* 45469 (DF141250; AFOSR-78-3524)

This work will study specific questions regarding the mathematical background of numerical methods for compressible flow

field computations. Problems of compressible flow require the solution of partial differential equations. This can be done by direct computational approach, or, usually under certain limiting assumptions, by analytic means. The asymptotic considerations to be done in this work represent an analytic approach under the assumption that the flow changes only slightly from station to station. Successful numerical work requires the understanding of the basic properties of the solution of the partial differential equation. A portion of this effort will be directed towards exploring this facet. Specific goals will be to creat expertise in computing methods for high-speed aerodynamics and to improve existing methods for transonic flow computations. The immediate pay-off will be improvement of methods of computing flow fields which lead to either a reduction in computing time, an increase of accuracy, or to the possibility of attacking problems of a bigger scope. The perceived long-range pay-off will be improvement in the design of airfoils and reduction of flutter problems.

A study of the detailed mathematical properties of numerical algorithms for the computation of transonic flow fields will be made. The feasibility of using the method of characteristics for the computation of the supersonic part of the flow field will be examined. A comparison will be made of different iteration schemes, including finite element schemes, from the point of view of computational economy. If time permits, an attempt will be made to develop a method for the computation of linearized supersonic flows based on integral equation techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

7.0008, IDENTIFICATION OF HEREDITARY CONTROL SYSTEMS VIA APPROXIMATION TECHNIQUES 15561-M
J.A. Burns, Virginia Polytechnic Inst. & State University, School of Arts & Sciences, Dept. of Mathematics, *Blacksburg, Virginia* 24061 (DA0F9224; DAAG29-78-G-0125)

To develop identification techniques and computational methods of parameter estimation for dynamical systems governed by functional differential equations. Relevance - the work may lead to efficient numerical techniques that could be profitably employed in such Army applications as control and stabilization studies (ARRADCOM-SCL), improved modeling of helicopter dynamics (AVRADCOM), and tactical missile system aerodynamics (MIRADCOM).

The research will be based on the state space formulation for hereditary control systems and approximation techniques for functional differential equations.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

7.0009, MGT TOOLS CASE STUDY
R. Black, Boeing Computer Services Inc., *P.O. Box 24346, Seattle, Washington* 98124 (DF729260; F30602-78-C-0044)

The objective is to examine in depth a large ongoing development program with advanced management tools and procedures carefully selected to complement advanced software production technology.

The approach of this effort is to examine the NASA IPAD (integrated program for aerospace vehicle design) documentation and to assess its potential for use in validating management models to be developed in the subsequent year. The IPAD program under contract to BCS is the only known program appropriately instrumented to yield data which appears useful to validate several planning and assessment models. The ultimate end item is checklists and SOPS for planning, reviewing, and acting on software development products.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, EPITAXIAL GROWTH OF GE-GAAS
R.D. Fairman, Rockwell International Corp., *1049 Camios Dos Rios, Thousand Oaks, California* 91360 (DF044620; F44620-76-C-0134)

AF function - microwave solid-state electronic devices are essential components of Air Force surveillance, electronic countermeasures, and communications systems. Opportunity - GaAs Impatt diodes are limited in their efficiency due to the fact that the same material is used in both the avalanche and drift regions of the device. An improvement in efficiency is possible by using a narrow bandgap material for the avalanche zone and a high drift velocity material in the drift region. Objective - the objective of this research is to investigate and offer solutions to these epitaxial materials growth problems which have in the past precluded the synthesis of device quality Ge-GaAs heterojunctions and the rapid exploitation of this promising material for Impatt-type electron devices. How work contributes - a properly grown heterojunction of this type with Ge (narrow bandgap) and GaAs (high velocity) promises to produce Impatt devices with efficiencies up to 25 percent greater than those of GaAs read-type Impatts.

The present work has been a fundamental study of the growth and materials problems encountered in the synthesis of Ge-GaAs heterojunctions by liquid phase epitaxy (LPE). One of the main problems with LPE growth of Ge-GaAs heterojunctions is autodoping due to substrate dissolution. In attempts to solve this problem, the thermodynamics of various Pb-Ge melt systems (in contact with Ge and GaAs substrates) have been studied very carefully with respect to crystal growth kinetics, using transparent LPE reactors of novel design with carefully controlled thermal gradients and supercooling capabilities. Ge epilayers have been grown on both semi-insulating and conducting GaAs substrates. But the autodoping problem has not been solved satisfactorily and the Ge epitaxy has not met expectations. Consequently, the approach of this effort will be changed to a new (cold wall) heteroepitaxy technique, plasma enhanced CVD, one which has potential of solving the autodoping problem and of lowering background contamination in the Ge epitaxy. It also offers advantage of an in-situ approach (Ge VPE plus GaAs LPE), given the compatibility of the plasma and LPE reactors. Epilayers will be characterized by scanning electron microscopy, current-voltage and Hall mobility measurements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0002, THEORETICAL SOLID-STATE PHYSICS
M.L. Cohen, University of California, Berkeley Campus, School of Letters & Science, Dept. of Physics, *Berkeley, California* 94720 (DMR7822465)

Research previously supported by DMR7620647.

Theoretical research will be carried out in several areas of solid state physics. These will include: (1) The estimate of local field effects, and the consequences for the theories of excitonic superconductivity and lattice dynamics. (2) The electronic structure of heterojunctions. This will involve the determination of the surface states at the interface between two semiconductors. (3) Total energy calculations, which will be particularly important for the estimate of surface relaxation. (4) The electronic structure of superconductors. This study will concentrate on the band structures of copper chloride, which has been suggested as possibly having a high transition temperature, and the A15 compounds. (5) The theory of the electron-phonon interaction and its effect on the transition temperature superconductors. (6) The electronic structure of adsorbates on solid surfaces. (7) The development of first principles pseudopotentials. (8) The theory of the motion of Bloch walls in ferromagnets. (9) The electronic states of muonium and electron-hole drops in semiconductors.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0003, A LABORATORY STUDY OF MAGNETOSPHERIC PROCESSES
R.S. White, University of California, Riverside Campus, Inst. of Geophysics & Planetary Physics, *Riverside, California* 92502 (ATM7819231)

The Institute of Geophysics and Planetary Physics at the University of California, Riverside, operates a unique facility for the study of magnetohydrodynamic processes related to solar flares and magnetospheric substorms. The research provides an experimental foundation for a theory of basic magnetic processes of interest to solar and space physics.

Previous research on several neutral point devices has led to new ideas about solar flare mechanisms while verifying some older ones. With the support provided here, work will be completed. The results are expected to aid interpretation of observations and soiar flare prediction efforts.

A new effort will be started on a second generation terrella device simulating the terrestrial magnetosphere. Fundamental problems in magnetospheric structure and dynamics will be investigated: merging entry layer, mantle, convection, energy storage, substorms, acceleration mechanisms.

The basic techniques are those of plasma physics and require ultra-fast photography, magnetic field and flux measurements, and particle density, current density, and electric field measurement. In addition, energetic X-rays and particles will be detected. These techniques have all been developed for previous measurements at the University of California, Riverside.

The major aim is to use laboratory techniques to investigate space plasma behavior.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

8.0004, MOLECULAR AND SOLID-STATE SPECTROSCOPY

W.C. Walker, University of California, Santa Barbara Campus, School of Letters & Science, Dept. of Physics, *Santa Barbara, California* 93106 (PHY7422174A05)

The proposed research is oriented toward providing a more complete understanding of the problems currently being studied. Observations of very small pure metal particles (2nm) nucleated in an inert gas atmosphere by two different techniques will be improved. Additional work on particle formation in the presence of an oxidant will be carried out. Research in matrix-isolation spectroscopy and spectroscopy of condensed gases will be continued. The gases to be studied are simple molecules, in particular carbon monoxide. Comparison to recently completed experiments will be made.

This is a supplement to complete research currently being supported under NSF grant PHY74-22174AO4.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0005, ADSORPTION OF MOLECULES ON GRAPHITE SURFACES

D.G. Onn, University of Delaware, School of Arts & Sciences, Dept. of Physics, *Newark, Delaware* 19711 (DF049480; AFOSR-77-3393)

AF function - airborne systems utilized for command, control, communications, reconnaissance and surveillance depend heavily upon interconnected electronic components. Opportunity - improved performance of these systems can be expected from the use of lighter materials such as intercalated graphite compounds for electrical conductors. Objective - the objective is to contribute to the understanding of the basic physical properties of intercalated graphite compounds. How work contributes - intercalated graphite compounds, weighing about one fourth of that of copper, have the potential of having conductivities greater than that of copper. This work should contribute to the development of intercalated graphite compounds that could replace copper as the dominant electrical conductor for airborne systems.

A systematic understanding of the thermal properties of both donor and acceptor type intercalated graphite compounds will be obtained. The specific heat will be determined for well-characterized single crystal samples of selected intercalated compounds of both donor and acceptor types over the temperature range 0.4K to 300K, providing information on the electronic density of states and on phonon properties as reflected in the debye temperature. In addition the thermal conductivity and the thermoelectric power will be determined for these materials.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0006, THEORETICAL STUDIES OF SOLIDS

K.L. Ngai, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN220077)

To obtain a basic understanding of the physics and chemistry of semiconductors, as well as ferroelectrics, pyroelectrics, and other materials exhibiting phase transitions. Those aspects involved in providing the development and characterization of materials needed for high-performance and/or less expensive electronic devices and components are emphasized.

Many-body techniques are used in the study of the lattice and electronic properties of semiconductors and pyroelectric materials in both the bulk and surfaces. Numerical calculations are performed for comparison with experimental data. Electronic states including bands and defects are calculated using pseudopotential and OPW techniques.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

8.0007, REVIEW AND EVALUATION OF PHYSICAL SCIENCES PROGRAM, AFOSR

R. Myers, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics, *College Park, Maryland* 20742 (DF018080; F44620-76-C-0074)

AF function - this contract will make available to the Directorate of Physics specialized research evaluation pertinent to the different disciplines in physics, especially those of primary interest to the Air Force. Deficiency - expertise in all fields of physics is needed and available only through access to investigators in the field. Objective - to permit the Directorate to more adequately plan research programs and to assess or interpret the merit of the research. Contribution - as stated above.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0008, THEORY OF THE ELECTRONIC PROPERTIES OF DISORDERED METALS

L.M. Schwartz, Brandeis University, School of Arts & Sciences, Dept. of Physics, *415 South St., Waltham, Massachusetts* 02154 (DMR7727249A01)

Theoretical research on the electronic properties of disordered condensed matter systems previously supported by DMR-7203209 A02 will be continued. Systems under investigation include substitutional and interstitial alloys, liquid metals, and metallic glasses with particular emphasis on noble metals and transition metal constituents. This research is directed to the development of new self-consistent formal techniques as well as the application of existing techniques such as the average t-matrix approximation to determine the electronic states and properties of disordered systems.

This is the second year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0009, PHYSICS OF THE QUASI-CONTINUUM OF POLYATOMIC MOLECULES

E. Yablonovitch, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Applied Physics, *Cambridge Station, Cambridge, Massachusetts* 02138 (DN875474; N00014-78-C-0531)

The technical objective of this work is to better understand the photophysics of the quasi-continuum in polyatomic molecules. This work is important to the Navy because of the need to better understand multiphoton processes as well as the possibility of introducing new techniques for selective photochemistry.

This work will involve an experimental study of the physics of the quasi-continuum levels in Sf(6). A TEA CO(2) laser is used to produce a heating pulse which is truncated by a plasma shutter at a specified time and which determines the energy fluence on the

sample. This pulse heats the Sf(6) molecules to a given vibrational temperature. At the same time part of the truncated pulse is split off and passed through an optical free induction decay cell to generate an untrashort probe pulse which is in synchronism with the trailing edge of the heating pulse. This ultrashort pulse is used to probe the partial recovery of the absorption after the heating pulse has been turned off by the plasma shutter. The fall time of the heating pulse and the duration of the probe pulse are both less than 30 picoseconds. The temporal resolution of this experiment is sufficiently fast to provide the first intramolecular relaxation time for a polyatomic molecule.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0010, CRYSTAL GROWTH BY SKULL MELTING 14080-PX

A. Linz, Massachusetts Inst. of Technology, School of Engineering, Dept. of Electrical Engin, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DA0E9123; DAAG29 76 C 0039)

To develop the skull growth of high-purity yttrium vanadate crystals. Relevance - yttrium vanadate crystals are attractive as a laser host material for use in laser rangefinders and target designators. This program will address the development of a growth technique for which crystals may be obtained free of inclusions, bubbles, and cleavage fractures due to poor diameter control.

A detailed electrical and thermal analysis of the skull system will be carried out to predict temperature profiles; electrical conductivity measurements will be obtained on the solid and liquid phases; and design of the skull growth process and growth and characterization of high-purity vanadate crystals will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0011, GRAVITATION, RELATIVITY AND COSMOLOGY

D.T. Wilkinson, Princeton University, Graduate School, Dept. of Physics, *205 Nassau Hall, Princeton, New Jersey* 08540 (PHY7821595)

Theoretical and experimental research on gravitation physics currently supported under NSF grant PHY76-82662 A01 will be continued. Among the topics in relativistic astrophysics, gravitation, and cosmology to be pursued are: 1. Studies of the shape of the sun (Dicke); 2. Statistics of galaxy clustering (Groth, Peebles); 3. Galactic halos and galactic evolution. CCD spectrophotometry of high redshift clusters (Loh, Wilkinson); 4. Systematic sampling of galaxy redshifts, (Peebles); 5. Balloon measurements of 3 degrees K background radiation isotropy (Wilkinson).

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0012, HIGH MOMENTUM TRANSFER ELASTIC SCATTERING AT HIGH ENERGIES

J. Orear, Cornell University, Ithaca Campus, School of Physical Sciences, Dept. of Physics, *Ithaca, New York* 14850 (PHY7711111A01)

This experimental program in elementary particle physics will study the properties of strong interactions. In order to learn more about the structures of the proton and the mechanisms of high-energy scattering this group will collaborate on an experiment at Fermi National Accelerator Laboratory to measure large-angle pion proton elastic scattering. The incident pion momentum will be 200GeV/C.

This is a continuation of NSF grant PHY77-11111.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0013, SOLIDS BY POSITRON ANNIHILATION

W. Brandt, New York University, School of Arts & Sciences, Dept. of Physics, *421 1st Ave., New York, New York* 10012 (DMR7681771A02)

The experimental and theoretical studies of positrons in solids previously supported by DMR74-11678 A02 will be continued. Efforts will be directed to further development of the theoretical basis for the positron method, the measurement of the transport properties of positrons in solids, and expansion of the analysis of positronium formation processes in dipolar and photomagnetic substances, and the investigation of the interaction of positrons with solid surfaces.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0014, SUPERCONDUCTIVITY AND RELATED PROPERTIES OF D-BAND METALS

P.B. Allen, State University of New York, Stony Brook Campus, School of Arts & Sciences, Dept. of Physics, *Stony Brook, New York* 11790 (DMR7900837)

Research previously supported by DMR7682946.

Theoretical research on the properties of metals will be undertaken which have a bearing on their superconducting transition temperatures. Numerical calculations for transition metals such as niobium and palladium will be done, as well as abstract theoretical work on the effect of impurities and thermal disorder. Three specific projects will be completed: (1) Modern methods of electron energy band theory will be used to perform calculations of the transition temperature and thermal and electrical resistivities of niobium and palladium. (2) These numerical results will be used to help analyze photoemission and other spectroscopic experiments. (3) Perturbation theory and other methods will be used to develop improved theories of the influence of disorder on such properties as the superconducting transition temperature, resistivity, magnetic susceptibility, high-temperature heat capacity and phase stability. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0015, TRANSPORT, THERMAL AND MAGNETIC PROPERTIES OF SOLIDS

J.A. Rayne, Carnegie Mellon University, Inst. of Technology, Dept. of Physics, *Frew Ave. & Margaret Morrison, Pittsburgh, Pennsylvania* 15213 (DMR7680939A02)

Research into the transport, thermal and magnetic properties of solids will be continued. The nature of amorphous metal alloys will be investigated by means of ultrasonic attenuation and velocity experiments, as well as by low-temperature heat capacity and transport measurements.

A study of the critical behavior of low-dimensional magnetic insulators also will be made using ultrasonic techniques. These techniques will also be applied to further investigations into the electronic scattering rate and the shear wave attenuation in transition metals. Collaborative studies on the magnetic properties of ternary palladium-silver-iron system, particularly in the spin-glass regime, will be undertaken by magnetoresistance and Mossbauer measurements.

This is a continuation of research supported under DMR73-07498.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0016, PHASE TRANSFORMATIONS AND NON-EQUILIBRIUM INTERFACES IN ALLOYS

J.S. Langer, Carnegie Mellon University, Mellon Inst. of Science, Dept. of Physics, *4400 5th Ave., Pittsburgh, Pennsylvania* 15213 (DF043970; F44620-76-C-0103)

AF function - this proposed research primarily falls in the 2.1 ROs which deal with new materials research. The goals are to form a rational basis for creating or improving material systems such as alloys, polymers, ceramics and composites. This can be attained through an understanding of the principles that govern the

properties and gross behavior as function of microstructural features. Deficiency - the understanding of phase transformations is of vital importance to the development of desirable material properties by the metallurgists. This is especially true for aircraft applications where high performance-to-weight ratios are vital, as, for example, in the lightweight titanium-based alloys. Objective - studies in the theory of interfacial morphology with emphasis on the stability of cellular structure which form during directional solidification will be performed. Work toward a new theory of dentritic growth will continue and development of a theory on the kinetics of phase separation in alloy solids and in multi-component fluids will begin. Contribution - this research is a part of a new comprehensive program in statistical mechanics to understand the problems associated with the foundation of new alloys which the AF needs for future weapons systems.

It is proposed to study phase transitions occurring in non-equilibrium interfaces in alloys specifically focusing attention to solidification theory and precipitation kinetics. The basic problem may be stated in the following way. Given a nonequilibrium situation in which one phase of a system tends to grow at the expense of another, predict how fast the new phase will grow and how its shape will evolve as a function of time. These studies will provide information on the stability of cellular structures which form during directional solidification and will lead to a better understanding of dendritic crystal growth.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0017, SURVEILLANCE - STRUCTURE AND INTERACTIONS OF MULTIPLE IONIZED IONS
I.A. Sellin, University of Tennessee, Knoxville Campus, School of Liberal Arts, Dept. of Physics, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (DN223272; N00014-75-C-0474)

This research provides data for developing models for understanding the properties of highly ionized atoms and interactions of these systems with other atomic species. Since these atomic species occur in high-temperature plasmas and violent collisions, understanding their properties and interactions is important to the Navy from the standpoint of modeling nuclear weapons detonations with high-temperature plasmas, studying solar activity which affects the ionosphere and studying the effects of a nuclear detonation on the environment.

Multiple electron excitation into projectile centered continuum states of highly ionized projectiles transversing lighter gas targets processes is being studied. Quantum beat-like oscillations from j equals 0, 1/2 atomic states are being investigated as well as quantum beat phenomena arising from collisions of highly stripped ions with neutral gases under single collision conditions.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0018, PROPERTIES OF LIQUID HELIUM FOUR
G.B. Hess, University of Virginia, School of Arts & Sciences, Dept. of Physics, *Garrett Hall, Charlottesville, Virginia* 22903 (DMR78-10778)

By studying the amplitude dependence of the resonant frequency of a Helmholtz resonator in the regime of vortex-free superfluid flow, the experimental observation has been made of the dependence of the superfluid density on the difference between the superfluid and normal fluid velocity. A systematic study of this dependence will be made, with emphasis on the region near the transition temperature where there are problems with the theory of the superfluid density. This work is important for understanding the hydrodynamics of quantum fluids.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, HIGH-SPECTRAL-RESOLUTION POLARIMETRY OF STARS
G.V. Coyne, University of Arizona, School of Liberal Arts, Dept. of Astronomy, *Tucson, Arizona* 85721 (AST7708386A02)

The aim of this study will be to obtain and interpret polarimetric data at high spectral resolution on a large sample of stars which are known to exhibit considerable polarization structure with wavelength. These include Be and shell stars, close binaries, X-ray binaries, dwarf novae and late-type giant stars. This work will be directed towards an interpretation of those stellar objects with extended atmospheres and/or circumstellar environments, including stars involved in mass exchange or mass loss.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0002, SPACE RESEARCH TECHNOLOGY
T.A. Chubb, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN320221)

To develop and construct demonstration devices of value to the Navy and DOD based on technology developed for the rocket program, e.g., IR, visible and UV surveillance sensors based on image converters and solid-state arrays used in space astronomy. To develop devices needed for the NRL rocket and satellite program, position determining X-ray sensors, band-sensitive optical detectors, thick-film electronic packaging techniques and counter-shift register circuitry, telemetry decoding systems and computer data interfaces.

Image converter designs developed in the far UV astronomy program are adapted to other spectral bands. Imaging techniques are developed for X-rays. Large area X-ray sensors are developed for X-ray astromony. Spectral modulation sensor systems are developed to detect line radiation sources against continuum background in IR.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

10.0003, STUDIES OF POPULATION II STARS AND SUPERGIANT STARS
H.E. Bond, Louisiana State University, Agricultural & Mechanical College, School of Chemistry & Physics, Dept. of Physics & Astronomy, *University Station, Baton Rouge, Louisiana* 70803 (AST7825538)

The observational research to be carried out in this project will be concerned with aspects of the synthesis of chemical elements inside stars. The stars to be studied belong to the following groups: (1) Subgiant CH stars. This new class of stars shows enhanced abundances of elements produced by helium-burning and neutron-capture reactions. Spectroscopic abundance analyses will be made of several of these stars. There will be a search for more stars of this type, both in globular star clusters and in the general region of space near the Sun. (2) Extremely metal-deficient stars. There will be abundance analyses of several very metal-deficient stars. The mass loss from such stars will be studied. These stars are believed to be the oldest type of star in the Galaxy. (3) Supergiant stars. Supergiant stars are very young stars which have formed relatively recently. The chemical abundances in supergiant stars will be determined at various distances from the galactic center. This will be done in order to determine the variation in chemical composition in the Galaxy. The abundance of light elements will also be determined in these stars. Instruments to be used for these studies include the Palomar 5-meter, the Mount Wilson 2.5-meter, the Kitt Peak National Observatory 4-meter, the McDonald 2.7-meter, and the Cerro Tololo Inter American Observatory 1.5-meter telescopes.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0004, AURORAL AND AIRGLOW EMISSION PROCESSES
A. Dalgarno, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Astronomy, *Cambridge Station, Cambridge, Massachusetts* 02138 (ATM7820971)

This grant funds a combination of atmospheric and molecular calculations that address various problems of interpretation of measurements of the ultraviolet, visual and infrared emissions in the terrestrial airglow and in auroras. The secondary consequences of the emission of extreme ultraviolet photons will also be explored.

Of particular interest is an emission feature observed at 21500-A during auroral activity. The feature has been observed on several occasions and tentatively identified as the (1,0) gamma band of nitric oxide NO. However no other associated bands have been observed, and a number of studies have sought to explain the feature through various mechanisms. This research will carry out several related calculations leading to predicted resultant spectra that can be tested against newly available observing capabilities (sensitivities).

The detailed interpretation of this and other derived features should yield useful information about atmospheric composition, energetics, and transition/reaction properties.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

10.0005, STELLAR PHYSICS - RADIATION TRANSFER

E.H. Avrett, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138

Development of numerical methods for the solution of the equations of statistical equilibrium and the equation of radiative transfer in spectral lines and in continua.

Application of the numerical methods to solar and stellar lines of multi-level atoms, especially in a study of the chromospheric structure of the sun.

Investigation of the properties of radiation emerging from stochastic media, and media exhibiting horizontal structure.

Study of deviations from local thermodynamic equilibrium in stellar photospheres.

Determination of the source function from observations of solar lines by means of an inversion of the Laplace transform.

Development of methods for correcting observed spectral profiles for instrumental broadening and noise.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0006, CONSTRUCTION OF AN 8-13 MICRON FILTER-WHEEL SPECTROMETER FOR USE IN INFRARED ASTRONOMY

D.E. Kleinmann, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138 (460120)

The immediate objective of this project is the construction of a low-resolution (delta lambda/lambda approximately 0.015) spectrometer operating over the 8 - 13 micron interval. This spectrometer will be based on the circular variable filter.

The principal astronomical use of this spectrometer will be observational programs that are directed toward determining the mechanisms responsible for the enormous infrared power that has been observed from a large number of galaxies and H II regions. In fact, not only do many of these objects radiate most of their power in the infrared, but some of these galaxies are among the most luminous objects in the universe because of that radiated infrared power. The value of spectral information in the thermal infrared is that it reflects the physical conditions of atoms, molecules, and 'dust' grains where that infrared power is generated. Much of this important physical information is available only in the thermal infrared.

This spectrometer will also be used to take advantage of the unique combination of site and capabilities offered by the Tillinghast reflector in order to make the first precise direct absolute calibration in infrared astronomy.

SUPPORTED BY Smithsonian Institution, Office of Fellowships & Grants

10.0007, CALCULATING A LINE-BLANKETED MODEL ATMOSPHERE FOR THE SUN

R. Kurucz, Smithsonian Institution, Astrophysical Observatory, Solar & Stellar Physics Div, *60 Garden St., Cambridge, Massachusetts* 02138 (31S-4S50-03)

It is possible to formulate mathematical models of a star such as the sun that agree very closely with observations in the visible and infrared. However, when the models' predictions are extended into the ultraviolet there are large discrepancies because the models do not include the thousands of absorption lines that fill this wavelength region. This is known as the missing ultraviolet opacity problem.

Kurucz and Avrett have calculated the statistical representation for the line opacity with new data on over 1,000,000 lines and have computed an improved model for the sun to demonstrate that the missing ultraviolet opacity problem has indeed been solved. Having found that the method gives good results for the sun, they are applying it to a larger range of stellar problems.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0008, VERY LONG BASELINE INTERFEROMETRY

J.M. Moran, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138 (314-4R50-04)

In cooperation with various institutions, very long baseline interferometry experiments are conducted to determine the spatial structure of molecular line emission from galactic radio sources.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0009, POLARIMETRY AND PHOTOMETRY OF CYGNUS XI

J.C. Kemp, Oregon State Higher Education System, University of Oregon, School of Liberal Arts, Dept. of Physics, *1472 Kincaid St., Eugene, Oregon* 97401 (AST7723187A01)

This grant will provide funds to carry out a program of monitoring the X-ray binary star Cygnus XI. The monitoring will consist of polarimetric and photometric measurements using the 61-centimeter telescope at the Pine Mountain Observatory. This is of interest to astronomers because of the possibility that one of the objects is a black hole.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0010, PHOTOMETRY, SPECTROSCOPY AND INTERFEROMETRY OF IRREGULAR GALAXIES

G.H. deVaucouleurs, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (AST7808744)

A comprehensive photometric spectroscopic and interferometric study of late-type spirals and irregular galaxies, particularly of the magellanic type will be carried out. This is a relatively neglected field of optical extragalactic astronomy (excepting the Magellanic Clouds themselves), but one which is of special interest to radio astronomers because of the high hydrogen content of this class of galaxies, leading to a high rate of star formation, an abundance of supergiant stars and, in some sense, a rapid rate of evolution. The complex structure and internal motions of these irregular, often asymetric systems is also a challenge to theories of galaxy formation and dynamics.

The expected results of this project would provide observations for most of the nearest and/or largest magellanic irregulars and related late-type systems listed in the article by de Vaucouleurs and Freeman in Vistas in Astronomy, Volume 14 (1922). The DDO dwarfs detected at 21 cm. need to be observed. Information on the structure and morphology, luminosity and stellar density distributions, total magnitudes and effective diameters, colors, stellar and galaxian luminosity functions, distances and space density, H II regions and H emission, rotation, velocity dispersion and other motions, total masses and comparisons with H I data will be provided.

The tools and techniques for such a comprehensive study have been developed and are available to us at McDonald Observatory or through our associates. This is a continuation of research done under grant AST 75-22900 A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0011, A PANORAMIC DETECTOR FOR HIGH-DISPERSION ASTRONOMICAL SPECTROPHOTOMETRY
D.L. Lambert, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (AST7818265)

A new spectroscopic detector will be designed, fabricated and installed on the 2.7 meter telescope at the McDonald Observatory. The detector will employ eight diode arrays arranged end to end along the focal plane of the spectrograph camera in the Coude' spectrograph. The new detector will provide about 14,000 simultaneous data elements. It will exploit the high quantum efficiency, wide spectral bandpass, geometric stability, good dynamic range, linearity and photometric precision of the modern diode arrays. The new detector will have substantially improved signal-to-noise characteristics, greater spectral resolution and improved photometric stability over the present system.

The new detector will be used in observational programs including: Determination of the abundances of carbon, nitrogen, oxygen and other heavy metals in type F and G main sequence stars. Measurement of magnetic fields in selected stars. Analysis of densities and flows of ionized gas in close and rapidly evolving binary star systems. Measurement of accurate radial velocity variations in dwarf Cepheid and related stars.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0012, STAR DATE
H.J. Smith, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (OSS7824651)

Star Date is a series of nightly radio vignettes designed to stimulate interest among the general public in astronomy and the night sky. Each of the two-minute scripts is written for airplay between sundown and midnight, local time, anywhere in the continental United States. Topics introduce sky watching to those who know little or nothing about the night sky, and include simple astrophysical objects and concepts, anecdotes drawn from the history of astronomy, and skylore. The productions are produced in English and Spanish versions for free distribution to commercial and public radio stations throughout the United States.

SUPPORTED BY U.S. National Science Foundation, Office of Science & Society

GENERAL

11.0001, FLIGHT RESEARCH AIRCRAFT OF THE POST-WAR ERA
R.P. Hallion, Smithsonian Institution, Science & Technology, *1000 Jefferson Dr. S.W., Washington, District of Columbia* 20560

This investigation is intended to be an historical vehicle-by-vehicle study of postwar research aircraft. Each aircraft type will be examined with an in-depth critical analysis of its research function, accomplishments and contributions to aerospace research and development. Emphasis will be placed on American transonic, supersonic and hypersonic aircraft.

The research complements work on the Dryden Flight Research Center and is being conducted at a reduced level of activity until after completion of the Dryden History. Many of the records being reviewed on the Dryden History are pertinent to this research.

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VOLUME 17 NUMBER 19 / OCTOBER 8, 1979

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N79-28118* National Aeronautics and Space Administration, Washington, D. C.
AERONAUTICAL ENGINEERING: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 108
Apr. 1979 154 p
(NASA-SP-7037(108)) Avail: NTIS HC E02 CSCL 01A

This bibliography lists 517 reports, articles, and other documents introduced into the NASA scientific and technical information system in March 1979. Author

N79-28119# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
HIGH REYNOLDS NUMBER SUBSONIC AERODYNAMICS
Apr. 1969 584 p refs Lecture held at Rhode-Saint-Genese, Belgium, 21-25 Apr. 1969
(VKI-Lecture-Series-16) Avail: NTIS HC A25/MF A01

Problems associated with the design of large subsonic aircraft are addressed with emphasis on scale effect, aerodynamic loads, and the reduction of drag, noise, and vibration. The use of interactive systems and computer graphics in aircraft design is also examined. For individual titles, see N79-28120 through N79-28128.

N79-28120# Lockheed-Georgia Co., Marietta.
ADVANTAGES AND PROBLEMS OF LARGE SUBSONIC AIRCRAFT **c05**
B. H. Little, Jr. *In* Von Karman Inst. of Fluid Dyn. High Reynolds Number Subsonic Aerodyn. Apr. 1969 30 p refs (For primary document see N79-28119 19-01)
Avail: NTIS HC A25/MF A01

The current and projected demand for large subsonic aircraft, both commercial and military, is discussed with emphasis on the advantages provided by these aircraft in economy, drag reduction, passenger comfort, and lessened air traffic congestion. Aerodynamically, the most important problems to be solved concern: wing design for high subsonic speeds; wing design for good low speed performance; stability and aeroelastic effects; total configuration design and optimization; propulsion system integration requirements; and fluid flow scaling effects due to large vehicle size. The need for better mathematical tools to provide theoretical solutions to high speed wind design to supercritical flow problems is discussed. A.R.H.

N79-28121# Lockheed-Georgia Co., Marietta.
AEROMECHANICS **c02**
B. H. Little, Jr. *In* Von Karman Inst. for Fluid Dyn. High Reynolds Number Subsonic Aerodyn. Apr. 1969 80 p refs (For primary document see N79-28119 19-01)
Avail: NTIS HC A25/MF A01

Relatively speaking, low-frequency interactions between an aircraft and its flight environment are examined. The fundamental concepts of unsteady aerodynamics and the present status of unsteady aerodynamic theory are discussed. Significant problems related to large subsonic aircraft explored concern self-induced buffet, whirl flutter, wing flutter, transonic buffet, buzz phenomena, and aeroelastic optimization. A.R.H.

N79-28122# Lockheed-Georgia Co., Marietta.
SCALING EFFECTS ON SHOCK-INDUCED SEPARATION **c02**
B. H. Little, Jr. *In* Von Karman Inst. for Fluid Dyn. High Reynolds Number Subsonic Aerodyn. Apr. 1969 33 p refs (For primary document see N79-28119 19-01)
Avail: NTIS HC A25/MF A01

Data from wind tunnel tests and subsequent flight tests of the C-141 aircraft indicate strong possibility that scaling effects are associated with separation of the boundary layer at and downstream of the shock waves. Features of the general flow model used to establish scaling criteria are discussed. Experiments reported include investigations of shock-induced separation on circular arc airfoils in a small transonic nozzle; a study of the initial boundary layer effects on transonic shock-induced separation in an axisymmetric nozzle; tests of a simulated C-141 in the 4' x 6' nozzle, and tests of a swept wing panel model in the NASA-Ames 11 ft transonic tunnel. The sensitivty of flows with separation or incipient separation at the trailing edge and the conditions necessary for wind tunnel simulation of transonic flight are examined. A.R.H.

N79-28123# Lockheed-Georgia Co., Marietta. C-5A Aerodynamics Dept.
SCALING EFFECTS ON DRAG PREDICTION **c02**
J. H. Paterson *In* Von Karman Inst. for FLuid Dyn. High Reynolds Number Subsonic Aerodyn. Apr. 1969 36 p (For primary document see N79-28119 19-01)
Avail: NTIS HC A25/MF A01

The intended purpose of wind tunnel tests and the component drags which compose the total cruise drag are examined in this discussion of the effects of Reynolds number on drag. The prediction of full scale drag requires highly refined accurate wind tunnel procedures to insure that the transition from laminar to turbulent flow is identified or controlled. Experience with fixing the transition on C-5A models shows that some increment in drag-rise Mach number will be obtained full scale. The transition strip was located at 7% chord aft of the leading edge of the wing root, increasing to 19% at the tip. Calculations show that the nondimensional boundary layer thickness at 50% chord on the model is about 50% greater than predicted full scale values at 20% semispan and 32% at 95% semispan. A.R.H.

N79-28124# Southampton Univ. (England).
NOISE AND VIBRATION PROBLEMS: OUTLINE NOTES **c02**
P. E. Doak *In* Von Karman Inst. for Fluid Dyn. High Reynolds Number Subsonic Aerodyn. Apr. 1969 9 p (For primary document see N79-28119 19-01)
Avail: NTIS HC A25/MF A01

The fundamental concepts and techniques of aerodynamic noise and vibration are outlined. R.E.S.

N79-28125# Lockheed-Georgia Co., Marietta.
WING DESIGN, BODY DESIGN, HIGH LIFT SYSTEMS AND FLYING QUALITIES WITH INTRODUCTION **c05**
D. Ryle *In* Von Karman Inst. for Fluid Dyn. High Reynolds Number Subsonic Aerodyn. Apr. 1969 286 p (For primary document see N79-28119 19-01)
Avail: NTIS HC A25/MF A01

Aerodynamic design process techniques are discussed from an aircraft company's point of view. The following areas of design are described; (1) parametric design techniques; (2)wing design; (3) body design; (4) high lift systems; and (5) flying qualities. R.E.S.

N79-28126# Lockheed-Georgia Co., Marietta.
ADVANCED COMPUTER TECHNOLOGY IN AERODYNAMICS. LECTURE 1: COMPUTER-AIDED AIRCRAFT DESIGN **c05**
B. H. Little, Jr. *In* Von Karman Inst. for Fluid Dyn. High Reynolds Number Subsonic Aerodyn. Apr. 1969 37 p refs (For primary document see N79-28119 19-01)
Avail: NTIS HC A25/MF A01

Computer graphic applications to aerodynamics are presented. Computer programs on aircraft design, pressure reduction, numerical control, and structural analysis are described. R.E.S.

N79-28127# Technische Hogeschool, Delft (Netherlands).
ADVANCED COMPUTER TECHNOLOGY IN AERODYNAMICS: A PROGRAM FOR AIRFOIL SECTION DESIGN UTILIZING COMPUTER GRAPHICS **c02**
J. L. vaningen *In* Von Karman Inst. for Fluid Dyn. High Reynolds Number Subsonic Aerodyn. Apr. 1969 9 p (For primary document see N79-28119 19-01)
Avail: NTIS HC A25/MF A01

Results of calculations for airfoils section design utilizing computer graphics are summarized. R.E.S.

N79-28128# Technische Hogeschool, Delft (Netherlands).
ADVANCED COMPUTER TECHNOLOGY IN AERODYNAMICS: A PROGRAM FOR AIRFOIL SECTION DESIGN UTILIZING COMPUTER GRAPHICS **c02**
J. L. vaningen *In* Von Karman Inst. for Fluid Dyn. High Reynolds Number Subsonic Aerodyn. Apr. 1969 63 p refs (For primary document see N79-28119 19-01)
Avail: NTIS HC A25/MF A01

A computer program which enables a designer not only to analyze low speed characteristics of an airfoil of arbitrary shape, but also to obtain airfoils with improved pressure distribution is described. The aerodynamic subroutines used in the program are discussed extensively. R.E.S.

N79-28129# Information Spectrum, Inc., Warminster, Pa.
MAINTENANCE IMPROVEMENT: AN ANALYSIS APPROACH INCLUDING INFERENTIAL TECHNIQUES. VOLUME 1: OVERVIEW Final Report, 27 Dec. 1977 - 15 Mar. 1979
Milton Clyman and Philip S. Grenetz 15 Mar. 1979 42 p refs 3 Vol.
(Contract MDA903-78-C-0176)
(AD-A068380; ISI-W-7958-02A-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 01/3

This final report, contained in four volumes, presents the results of research into assessing the economic (cost and down-time) impact of Potentially Avoidable Maintenance actions for selected Naval aircraft subsystems. Maintenance actions requiring no repair and those resulting in induced defects and failure-to-correct were identified. Specific high-driver two-digit Work Unit Codes were analyzed for the F-14A Fire Control, S-3A Bombing Navigation, S-3A Landing Gear, and A-7E Bombing Navigation. GRA

N79-28130# Information Spectrum, Inc., Warminster, Pa.
MAINTENANCE IMPROVEMENT: AN ANALYSIS APPROACH INCLUDING INFERENTIAL TECHNIQUES. VOLUME 2: TECHNICAL REPORT Final Report, 27 Dec. 1977 - 15 Mar. 1979
Milton Clyman, Philip S. Grenetz, and Richard S. Schultz 15 Mar. 1979 190 p refs 3 Vol.
(Contract MDA903-78-C-0176)
(AD-A068381; ISI-W-7958-02B-Vol-2) Avail: NTIS HC A09/MF A01 CSCL 01/3

Research methodology, results, and recommendations are presented. The interim feasibility report is appended. A.R.H.

N79-28131# Information Spectrum, Inc., Warminster, Pa.
MAINTENANCE IMPROVEMENT. AN ANALYSIS APPROACH INCLUDING INFERENTIAL TECHNIQUES. VOLUME 4: SOFTWARE MANUAL Final Report, 27 Dec. 1977 - 15 Mar. 1979
Milton Clyman, Vito A. Gentile, and Philip S. Grenetz 15 Mar. 1979 164 p 3 Vol.
(Contract MDA903-78-C-0176)
(AD-A068383; ISI-W-7958-02D-Vol-4) Avail: NTIS HC A08/MF A01 CSCL 01/3

Volume IV includes the logic used to develop software for generating the tables in Volume III, user instructions, and a complete listing of programs that were executed to arrive at the tables. GRA

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N79-28132 Illinois Univ. at Urbana-Champaign.
CONVECTIVE HEATING IN A BALLISTIC DEVICE AS PREDICTED THROUGH TURBULENT UNSTEADY BOUNDARY LAYER DEVELOPMENT Ph.D. Thesis
Michael John Adams 1979 179 p
Avail: Univ. Microfilms Order No. 7915308

Gun tube wall temperature during the firing of a projectile was calculated. Internal flow structure was decoupled by specifying inviscid core properties through measured and assumed axial and temporal variations. A fluid mechanics model solved the unsteady, compressible, and turbulent momentum and energy boundary layer development at discrete piston locations. Shear layer solutions were coupled through the energy equation by consideration of radial heat conduction into the bore surface of the ballistic device in order to predict the interior wall temperature history at all locations behind a moving projectile. Comparison of results to predictions, which utilized the integral methods and assumed known heat transfer coefficients, indicates that conventional integral methods do not adequately represent the convective heat transfer process. In addition, bore transverse curvature is shown to be an important factor in the surface heating of small bore guns. Dissert. Abstr.

N79-28133 California Univ., Berkeley.
AN EXPERIMENTAL INVESTIGATION OF SUPERSONIC FLOW PAST CIRCULAR CONES AT HIGH ANGLES OF ATTACK Ph.D. Thesis
Abdollah Modavi 1978 140 p
Avail: Univ. Microfilms Order No. 7914703

A method is described for obtaining detailed velocity profiles about circular cones at high angles of attack. The primary tool employed in the detection of the velocity and the flow direction is a constant temperature hot wire probe. Velocity profiles are presented on the leeward side of a 10 deg (semi angle) cone with the angles of attack ranging from 10 deg to 30 deg at different values of the Reynolds number. All the velocity profiles related to the viscous flow are taken above the circumferential skin pressure orifices in order to provide pressure values for determination of the boundary layer flow. The positions of the imbedded shock waves are also explored at different values of the total pressure. Particular attention is paid to the regions of the flow where the onset of boundary layer transition may be expected. The leeward side of the model is scanned for detection of the asymmetrical vortex generation and also to provide insight into the position of the vortical singularity. Dissert. Abstr.

N79-28134*# Kentron International, Inc., Hampton, Va. Technical Center.

SENSITIVITY STUDY FOR A REMOTELY PILOTED MICROWAVE-POWERED SAILPLANE USED AS A HIGH-ALTITUDE OBSERVATION

R. Victor Turriziani Jun. 1979 15 p refs
(Contract NAS1-13500)
(NASA-CR-159089) Avail: NTIS HC A02/MF A01 CSCL 01A

The sensitivity of several performance characteristics of a proposed design for a microwave-powered, remotely piloted, high-altitude sailplane to changes in independently varied design parameters was investigated. Results were expressed as variations from baseline values of range, final climb altitude and onboard storage of radiated energy. Calculated range decreased with increases in either gross weight or parasite drag coefficient; it also decreased with decreases in lift coefficient, propeller efficiency, or microwave beam density. The sensitivity trends for range and final climb altitude were very similar. The sensitivity trends for stored energy were reversed from those for range, except for decreasing microwave beam density. Some study results for single parameter variations were combined to estimate the effect of the simultaneous variation of several parameters: for two parameters, this appeared to give reasonably accurate results. A.R.H.

N79-28135*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MEASUREMENTS IN THE TURBULENT BOUNDARY LAYER AT CONSTANT PRESSURE IN SUBSONIC AND SUPERSONIC FLOW. PART 2: LASER-DOPPLER VELOCITY MEASUREMENTS Final Report, May 1975 - Feb. 1978

Paul E. Dimotakis, Donald J. Collins, and Daniel B. Lang Arnold AF Base, Tenn. AEDC Jul. 1979 90 p refs
(Contracts NAS7-100; F44620-75-C-0007; AF MIPR-EY 7483-76-0003; AF MIPR-EY 7483-76-0009)
(NASA-CR-158839; JPL-Pub-79-41-Pt-2; AEDC-TR-79-49-Pt-2) Avail: NTIS HC A05/MF A01 CSCL 01A

A description of both the mean and the fluctuating components of the flow, and of the Reynolds stress as observed using a dual forward scattering laser-Doppler velocimeter is presented. A detailed description of the instrument and of the data analysis techniques were included in order to fully document the data. A detailed comparison was made between the laser-Doppler results and those presented in Part 1, and an assessment was made of the ability of the laser-Doppler velocimeter to measure the details of the flows involved. R.E.S.

N79-28136*# New York Univ., N. Y. Courant Mathematics and Computing Lab.
AN ARTIFICIAL VISCOSITY METHOD FOR THE DESIGN OF SUPERCRITICAL AIRFOILS

Geoffrey B. McFadden Jul. 1979 168 p refs
(Grants NGR-33-016-201; NsG-1579; Contract EY-76-C-02-3077)
(NASA-CR-158840; COO-3077-158) Avail: NTIS HC A08/MF A01 CSCL 01A

A numerical technique is presented for the design of two-dimensional supercritical wing sections with low wave drag. The method is a design mode of the analysis code H which gives excellent agreement with experimental results and is widely used in the aircraft industry. Topics covered include the partial differential equations of transonic flow, the computational procedure and results; the design procedure; a convergence theorem; and description of the code. A.R.H.

N79-28137*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SPACE SHUTTLE ORBITER TRIMMED CENTER-OF-GRAVITY EXTENSION STUDY. VOLUME 5: EFFECTS OF CONFIGURATION MODIFICATIONS ON THE AERODYNAMIC CHARACTERISTICS OF THE 140A/B ORBITER AT MACH NUMBERS OF 2.5, 3.95 AND 4.6

W. Pelham Phillips and Roger H. Fournier Jun. 1979 54 p refs
(NASA-TM-72661) Avail: NTIS HC A04/MF A01 CSCL 01A

Supersonic aerodynamic characteristics are presented for the 140A/B space shuttle orbiter configuration (0.010 scale) and for the configuration modified to incorporate geometry changes in the wing planform fillet region. The modifications designed to extend the orbiter's longitudinal trim capability to more forward center-of-gravity locations, included reshaping of the baseline wing planform fillet and adding canards. The investigation was made in the high Mach number test section of the Langley Unitary Plan Wind Tunnel at a Reynolds number of approximately 2.2 million based on fuselage reference length. The angle-of-attack range for the investigation extended from -1 deg to 31 deg. Data were obtained with the elevators and body flap deflected at appropriate negative and positive conditions to assess the trim limits. Author

N79-28138*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THE EFFECT OF CANARD RELATIVE SIZE AND VERTICAL LOCATION ON THE SUBSONIC LONGITUDINAL AND LATERAL-DIRECTIONAL STATIC AERODYNAMIC CHARACTERISTICS FOR A MODEL WITH A SWEPT FORWARD WING

Jarrett K. Huffman and Charles H. Fox, Jr. Jul. 1979 106 p refs
(NASA-TM-78739) Avail: NTIS HC A06/MF A01 CSCL 01A

A general research fighter model was tested in the Langley 7- by 10-foot high speed tunnel at a Mach number of 0.3. The model was tested with a 32 deg swept forward wing mounted in mid-, low-, and high-wing positions. For the mid-wing configuration, the model was tested with a 51.7 deg swept back canard mounted in mid-, low-, and high-canard positions. For the mid-wing mid-canard and the mid-wing high-canard configurations, canards of similar planform having two different areas were tested. The angle-of-attack range was from approximately -4 deg to 48 deg at sideslip angles of 0 deg, -5 deg, and 5 deg. Author

N79-28139*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PRESSURE DISTRIBUTIONS ON THREE DIFFERENT CRUCIFORM AFT-CONTROL SURFACES OF A WINGLESS MISSILE AT MACH 1.60, 2.36, AND 3.70. VOLUME 2: CLIPPED DELTA TAIL

Milton Lamb, Wallace C. Sawyer, Donald L. Wassum, and C. Donald Babb Aug. 1979 345 p
(NASA-TM-80097-Vol-2; L-12993-Vol-2) Avail: NTIS HC A15/MF A01 CSCL 01A

Pressure coefficients were obtained in the Langley Unitary Plan wind tunnel for a wingless missile with a clipped delta tail. The angle of attack was varied from -4 deg to 20 deg, model roll angle was varied from 0 deg to 90 deg in 22.5 deg increments, and tail deflections were 0 deg to - 15 deg. The pressures were measured on two adjacent tail surfaces using 91 pressure orifices per tail surface. Results are presented in plotted and tabular form. A.R.H.

N79-28140*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PRESSURE DISTRIBUTIONS ON THREE DIFFERENT CRUCIFORM AFT-TAIL CONTROL SURFACES OF A WINGLESS MISSILE AT MACH 1.60, 2.36, AND 3.70. VOLUME 3: CRANKED TAIL

Milton Lamb, Wallace C. Sawyer, Donald L. Wassum, and C. Donald Babb Aug. 1979 342 p
(NASA-TM-80097-Vol-3; L-12993-Vol-3) Avail: NTIS HC A15/MF A01 CSCL 01A

The results of pressure distribution tests are presented without analysis. The test Reynolds number used was 6.6. x 10 to the 6th power per meter. A.R.H.

N79-28141*# Rockwell International Corp., Columbus, Ohio.
LOW SPEED WIND TUNNEL TEST OF GROUND PROXIMITY AND DECK EDGE EFFECTS ON A LIFT CRUISE FAN V/STOL CONFIGURATION, VOLUME 1 Contractor Report, Mar. 1978 - Feb. 1979

V. R. Stewart May 1979 118 p
(Contract NAS2-9882)
(NASA-CR-152247; NR79H-12-Vol-1) Avail: NTIS HC A06/MF A01 CSCL 01A

The characteristics were determined of a lift cruise fan V/STOL

multi-mission configuration in the near proximity to the edge of a small flat surface representation of a ship deck. Tests were conducted at both static and forward speed test conditions. The model (0.12 scale) tested was a four fan configuration with modifications to represent a three fan configuration. Analysis of data showed that the deck edge effects were in general less critical in terms of differences from free air than a full deck (in ground effect) configuration. The one exception to this was when the aft edge of the deck was located under the center of gravity. This condition, representative of an approach from the rear, showed a significant lift loss. Induced moments were generally small compared to the single axis control power requirements, but will likely add to the pilot work load. R.E.S.

N79-28142*# Rockwell International Corp., Columbus, Ohio.
LOW SPEED WIND TUNNEL TEST OF GROUND PROXIMITY AND DECK EDGE EFFECTS ON A LIFT CRUISE FAN V/STOL CONFIGURATION, VOLUME 2 Contractor Report, Mar. 1978 - Feb. 1979
V. R. Stewart May 1979 484 p
(Contract NAS2-9882)
(NASA-CR-152248; NR79H-12-Vol-2) Avail: NTIS HC A21/MF A01 CSCL 01A

The following test results are appended: (1) wind tunnel data, (2) static thrust stand data, and (3) fan calibration data. R.E.S.

N79-28143*# General Dynamics Corp. Fort Worth, Tex.
AERODYNAMIC CHARACTERISTICS OF FOREBODY AND NOSE STRAKES BASED ON F-16 WIND TUNNEL TEST EXPERIENCE. VOLUME 1: SUMMARY AND ANALYSIS Final Report, 1 Sep. 1977 - 30 Sep. 1978
C. W. Smith, J. N. Ralston, and H. W. Mann Jul. 1979 145 p refs
(Contract NAS1-15006)
(NASA-CR-3053) Avail: NTIS HC A07/MF A01 CSCL 01A

The YF-16 and F-16 developmental wind tunnel test program was reviewed. Geometrical descriptions, general comments, representative data, and the initial efforts toward the development of design guides for the application of strakes to future aircraft are presented. R.E.S.

N79-28144# Aeronautical Research Labs., Melbourne (Australia).
LONGITUDINAL AERODYNAMICS EXTRACTED FROM FLIGHT TESTS USING A PARAMETER ESTIMATION METHOD
R. A. Feik Oct. 1978 33 p refs
(ARL/Aero-Note-379; AR-001-308) Avail: NTIS HC A03/MF A01

Flight data from a 60 deg delta wing fighter aircraft were analyzed using a modified Newton-Raphson parameter estimation procedure. The model equations used for the analysis were extended to account for incidence vane errors and non-linearities in the pitching moment curves. Longitudinal derivatives extracted from the data have been compared with wind tunnel measurements and some theoretical estimates and areas of agreement and disagreement identified. The results demonstrate the usefulness of the parameter identification method, not only for the validation of aircraft mathematical models and for checking flight results against wind tunnel data, but also for obtaining aerodynamic data not easily available through other means. A.R.H.

N79-28145# Indian Inst. of Tech., Bombay. Dept. of Aeronautical Engineering.
APPLICATION OF VORTEX LATTICE METHOD FOR THE EVALUATION OF THE AERODYNAMIC CHARACTERISTICS OF WINGS WITH AND WITHOUT STRAKES M.S. Thesis
Jatinder Singh 1979 114 p refs
Avail: NTIS HC A06/MF A01

Wings characterized by small aspect ratio and large leading-edge sweep exhibit separation along leading-edge and side-edge. Well defined vortex over leading-edge and side-edge gives rise to incremental vortex lift. The aerodynamic characteristics of more generalized planforms incorporating incremental vortex lift are determined by using vortex lattice method to calculate the aerodynamic characteristics for potential flows. The effects of the leading edge vortex, tip vortices, and the detached leading edge and side edge vortices over the lifting surface are considered. A flow chart and input parameters for wings with and without strakes are given for a program calculating the aerodynamic characteristics of a planar wing in symmetric flight in an incompressible flow. Predicted values are compared with experimental results. A.R.H.

N79-28146*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
WING AERODYNAMIC LOADING CAUSED BY JET-INDUCED LIFT ASSOCIATED WITH STOL-OTW CONFIGURATIONS
U. vonGlahn and D. Groesbeck 1979 40 p refs Presented at Atmospheric Flight Mech. Conf., Boulder, Colo., 6-8 Aug. 1979; sponsored by AIAA
(NASA-TM-79218; E-110) Avail: NTIS HC A03/MF A01 CSCL 01A

Surface pressure distributions were obtained with model-scale STOL-OTW configurations using various nozzles designed to promote flow attachment to the wing/flap surface. The nozzle configurations included slot-types and both circular and slot nozzles with external flow deflectors. The wing aerodynamic loading caused by the jet-induced lift is presented in conventional terms of delta p/q as a function of chordwise surface distance in the nozzle centerline plane as well as outboard of the nozzle centerline. Nozzle roof/deflector angle, chordwise location of the nozzle, wing size, and flap deflection angle are included in the geometric variables affecting the wing loading. A.R.H.

N79-28147# Applied Science Research Associates, Inc., New York, N. Y.
ANALYTICAL AND NUMERICAL INVESTIGATION OF TRANSONIC AND SUPERSONIC FLOWS Final Scientific Report, 15 May 1977 - 31 Jan. 1979
31 Jan. 1979 28 p refs
(Contract N00014-77-C-0359)
(AD-A067749) Avail: NTIS HC A03/MF A01 CSCL 20/4

All the work was in the area of gasdynamics, and our main area of research has been cases of flows containing shockwaves. For the most part we have taken an approach which straddled the borderline of analytical and numerical methods. This is best exemplified by the work discussed in which classical boundary layer methods are used to develop variable mesh numerical schemes and in which the theory of characteristics, Riemann invariants, and shock expansion theory are all used to obtain a robust method of numerical integration which is orders of magnitude faster than any other known scheme. GRA

N79-28148# ARO, Inc., Arnold Air Force Station, Tenn.
ARTIFICIALLY INDUCED TRANSITION RESULTS FROM A 7-DEG, 14-7-DEG BICONIC, AND 5-DEG, CONE AT MACH 9 IN THE AEDC-VKE TUNNEL F Final Report, 13 Jul. - 16 Aug. 1978
A. H. Boudreau AEDC Sep. 1978 28 p refs
(AD-A067601; AEDC-TSR-78-V30) Avail: NTIS HC A03/MF A01 CSCL 20/4

Tests are described which measured the artificially induced transition location on a slightly blunted 7-deg cone. Various distributed roughness and spherical type boundary layer trips were used. The tests were conducted at Mach 9 over a free stream Reynolds number range from 500,000/ft. to 20,000,000/ft. Test results are not included in the report. Author (GRA)

N79-28149# Auburn Univ., Ala. Dept. of Aerospace Engineering.
AN AERODYNAMIC ANALYSIS OF DEFORMED WINGS IN SUBSONIC AND SUPERSONIC FLOW Interim Report, Jan. - Dec. 1978
John E. Burkhalter, Milton E. Vaughn, Jr., and John M. Abernathy Mar. 1978 54 p refs
(Grant DAAG29-78-G-0036)
(AD-A067586) Avail: NTIS HC A04/MF A01 CSCL 20/4

The aerodynamic loading for deformed wings in both subsonic and supersonic flow has been under study for the past year. The basic solution technique falls into the potential flow category with appropriate restrictions. A lifting surface kernel function formulation is used for both subsonic and supersonic flow and

results are obtained which agree very well with experimental data. Subsonic solutions for deformed wings with deflected elevons are obtained in a semi-closed form summation manner. Cases under study which include gaps between the elevon wings are as yet incomplete but are presently being pursued. For supersonic flow, a modified Evvard solution forms the basis for the planar wing cases and vorticity paneling is added to account for local deformations in the wing mean camber surface. Results are obtained which agree very well with experimental data. The gapped elevon cases for supersonic flow is also analyzed and preliminary results have identified thickness effect, as being very important, at least for small elevon deflections. Author (GRA)

N79-28150# Texas A&M Univ., College Station. Dept. of Aerospace Engineering.

DEFINE AND STUDY FREE BALLOON DESIGN PROBLEMS Final Report, 1 Jan. 1976 - 31 Aug. 1978

James L. Rand Hanscom AFB, Mass. AFGL Nov. 1978 32 p refs

(Contract F19628-76-C-0082; AF Proj. 6665)

(AD-A067716; TAMRF-3332-3; AFGL-TR-78-0295) Avail: NTIS HC A03/MF A01 CSCL 01/3

The results of a two year effort to define and study problems associated with the design of scientific balloons are summarized. These results include: the development of a design program including material deformation; an analysis program for use in off-design configurations; uniaxial and biaxial constant rate testing; uniaxial creep testing; and uniaxial material characterization. In addition, the need for further investigation is elaborated. Author (GRA)

N79-28151# Analytical Methods, Inc., Bellevue, Wash.

AN INVESTIGATION OF SEPARATION MODELS FOR THE PREDICTION OF C SUB LAMBDA SUB MAX Final Technical Report, 16 Feb. 1976 - 15 Feb. 1979

Frank A. Dvorak, Brian Maskew, and Balusu M. Rao Apr. 1979 58 p refs

(Contract DAAG29-76-C-0019)

(AD-A068108; ARO-13225.2-E) Avail: NTIS HC A04/MF A01 CSCL 20/4

Steady and unsteady analyses and computational methods have been developed for calculating the flow about two-dimensional airfoils up to and beyond the stall. The steady-flow method adopts an iterative procedure between the potential flow and boundary layer solutions. The separated region is modeled in the potential flow analysis using free vortex sheets which require an inner iteration to establish their shapes. The free vortex sheet length is an important parameter in the potential flow calculation. Calculated and experimental results are compared for a GA (W) -1 airfoil and for several NACA airfoil series over a range of Reynolds numbers. The calculated results, which include pressure, distributions as well as force and moment characteristics, are in very close agreement with experimental results, and are obtained for reasonable computing costs; typically, one incidence data point takes 15 to 20 c.p. seconds on a CDC 7600 computer. GRA

N79-28152# Pennsylvania State Univ., University Park. Applied Research Lab.

FLOW OVER AN AXISYMMETRIC BODY IN A CYLINDRICAL TUNNEL

J. Fernandez 1 Mar. 1979 49 p refs

(Contract N00024-79-C-6043)

(AD-A068610; ARL/PSU/TM-79-31) Avail: NTIS HC A03/MF A01 CSCL 20/4

The flow past an axisymmetric body in a cylindrical tunnel is of practical importance in the study of wind or water tunnel blockage effects and in the analysis of high speed tube transportation vehicles. The present study employs the Green's Function method to analyze the flow past arbitrary axisymmetric bodies in cylindrical tunnels. Towards this end, the appropriate fundamental solution to the Laplace's equation is developed. This solution automatically satisfies the boundary conditions at the tunnel wall and at the upstream and downstream infinities. The boundary condition at the body is formulated into an integral equation of the second kind. A numerical method is employed for the solution of the integral equation. It is shown further that the limiting case of the flow in a tunnel of infinite radius agrees very well with the previously known flow in an unbounded medium. The present method has been employed for the analysis of various body shapes of interest. The results show excellent agreement in cases when exact analytical solutions are available. The present method has also been found to be computationally efficient. GRA

N79-28153# ARO, Inc., Arnold Air Force Station, Tenn.

STATIC FORCE TESTS OF CONIC AND BICONIC BODIES AT MACH NUMBER 10 Final Report

Jerry S. Hahn AEDC Nov. 1978 23 p ref

(AD-A068320; AEDC-TSR-78-V40) Avail: NTIS HC A02/MF A01 CSCL 20/4

A static force test was conducted in the hypersonic Mach number regime to obtain experimental aerodynamic data on conic and biconic bodies. The test was performed at a nominal Mach number of 10 at a free-stream unit Reynolds number of one million per ft. The angle-of-attack range was -14 to 14 deg. Model flow-field photographs and oil-flow photographs were obtained on several configurations at selected model attitudes and test conditions. GRA

N79-28154# Ballistic Research Labs., Aberdeen Proving Ground, Md.

COMPUTATION OF TRANSONIC FLOW PAST PROJECTILES AT ANGLE OF ATTACK Final Report

R. P. Reklis, W. B. Sturek, and F. R. Bailey Feb. 1979 29 p refs

(DA Proj. 1L1-61102-AH-43)

(AD-A069106; AD-E430233; ARBRL-TR-02139) Avail: NTIS HC A03/MF A01 CSCL 19/4

Aerodynamic properties of artillery shell such as normal force and pitching moment reach peak values in a narrow transonic Mach number range. In order to compute these quantities, numerical techniques have been developed to obtain solutions to the three-dimensional transonic small disturbance equation about slender bodies at angle of attack. The computation is based on a plane relaxation technique involving Fourier transforms to partially decouple the three-dimensional difference equations. Particular care is taken to assure accurate solutions near corners found in shell designs. Computed surface pressures are compared to experimental measurements for circular arc and cone cylinder bodies which have been selected as test cases. Computed pitching moments are compared to range measurements for a typical projectile shape. GRA

N79-28155# Nielsen Engineering and Research, Inc., Mountain View, Calif.

A TRANSONIC WIND TUNNEL INTERFERENCE ASSESSMENT: AXISYMMETRIC FLOWS Interim Report

S. S. Stahara and J. R. Spreiter (Stanford Univ.) Jan. 1979 11 p refs Presented at the 17th Aerospace Sci. Meeting, New Orleans, 15-17 Jan.

(Contracts F44620-75-C-0047; DAAG29-77-C-0038; AF Proj. 2307)

(AD-A068767; AFOSR-79-0627TR) Avail: NTIS HC A02/MF A01 CSCL 20/4

A wind tunnel interference assessment concept which presents a rational predictive means of wall interference analysis is evaluated. The procedure consists of employing as an outer boundary condition an experimentally-measured pressure distribution along a convenient control surface located inward from the actual tunnel walls. Attention has been focused on axisymmetric flows in the transonic regime where tunnel interference is high and where the experimentally-measured conditions on the control surface are of mixed subsonic/supersonic type. Based on the transonic small-disturbance equation, results for surface and near flow field pressure distributions are presented for a variety of different slender body shapes. These calculations indicate both the accuracy of the procedure as well as its ease of implementation. The procedure relates directly to the correctable-interference wind tunnel concept recently suggested. GRA

N79-28156# Massachusetts Inst. of Tech., Cambridge. Fluid Dynamics Research Lab.

AN OFF DESIGN SHOCK CAPTURING FINITE DIFFERENCE APPROACH FOR CARET WAVERIDER CONFIGURATIONS Final Report, 1 Apr. 1977 - 31 Dec. 1978

Judson R. Baron and I. Efrat Feb. 1979 96 p refs
(Contract F49620-77-C-0090; AF Proj. 2307)
(AD-A068819; AFOSR-79-0517TR) Avail: NTIS HC A05/MF A01 CSCL 20/4

The three dimensional off design flow fields are calculated for stream Mach numbers in the range 1.3 to 4.0 and corresponding to attached and detached shocks at the leading edges of a reentrant pyramidal waverider geometry. The MacCormack shock capturing version of the Lax-Wendroff finite difference technique is used with grids chosen to align with surface, symmetry and approximate shock traces in the transverse plane. Separate natural grid systems are defined for the compression and expansion regions, and an alternating region algorithm is used in combination with a sequential transfer of the edge region boundary conditions. The latter are derived from overlapping portions of the computational grids as integration proceeds axially to an asymptotic conical field. Equivalent attached shock cases result from either of two approaches: the alternating region algorithm, or a consideration of solely the compression region with uniform unknown conditions assumed near the edges. For detached shock cases overall lift and drag coefficients exhibit smooth variations between the attached edge and detached apex limits. GRA

N79-28157# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
UNSTEADY SMALL-GAP GROUND EFFECTS
E. O. Tuck Mar. 1979 47 p
(Contract N00014-76-C-0157; NR Proj. 062-230)
(AD-A068400; E-97B-54) Avail: NTIS HC A03/MF A01 CSCL 20/4

Fluid-dynamic problems involving bodies moving close to walls are of interest in many different contexts, and there is a considerable literature dealing with such problems. The present paper concerns itself with phenomena which can be treated on an inviscid-fluid basis, and hence has little connection with the important branch of that literature dealing with low-Reynolds-number wall effects. The small-gap regime is defined, formally, as that in which the clearance is small compared to the horizontal length scale. Flow induced by a body moving near a plane wall is analysed on the assumption that the normal distance from the wall of every point of the body is small compared to the body length. The flow is irrotational except for the vortex sheet representing the wake. The gap-flow problem in the case of unsteady motion is reduced to a nonlinear first-order ordinary differential equation in the time variable. Problems solved include airfoil starting flows and their transient wakes, and flat plates falling toward the ground. GRA

N79-28121# Lockheed-Georgia Co., Marietta.
AEROMECHANICS
B. H. Little, Jr. *In* Von Karman Inst. for Fluid Dyn. High Reynolds Number Subsonic Aerodyn. Apr. 1969 80 p refs (For primary document see N79-28119 19-01)
Avail: NTIS HC A25/MF A01

N79-28122# Lockheed-Georgia Co., Marietta.
SCALING EFFECTS ON SHOCK-INDUCED SEPARATION
B. H. Little, Jr. *In* Von Karman Inst. for Fluid Dyn. High Reynolds Number Subsonic Aerodyn. Apr. 1969 33 p refs (For primary document see N79-28119 19-01)
Avail: NTIS HC A25/MF A01

N79-28123# Lockheed-Georgia Co., Marietta. C-5A Aerodynamics Dept.
SCALING EFFECTS ON DRAG PREDICTION
J. H. Paterson *In* Von Karman Inst. for FLuid Dyn. High Reynolds Number Subsonic Aerodyn. Apr. 1969 36 p (For primary document see N79-28119 19-01)
Avail: NTIS HC A25/MF A01

N79-28124# Southampton Univ. (England).
NOISE AND VIBRATION PROBLEMS: OUTLINE NOTES
P. E. Doak *In* Von Karman Inst. for Fluid Dyn. High Reynolds Number Subsonic Aerodyn. Apr. 1969 9 p (For primary document see N79-28119 19-01)
Avail: NTIS HC A25/MF A01

N79-28127# Technische Hogeschool, Delft (Netherlands).
ADVANCED COMPUTER TECHNOLOGY IN AERODYNAMICS: A PROGRAM FOR AIRFOIL SECTION DESIGN UTILIZING COMPUTER GRAPHICS
J. L. vanIngen *In* Von Karman Inst. for Fluid Dyn. High Reynolds Number Subsonic Aerodyn. Apr. 1969 9 p (For primary document see N79-28119 19-01)
Avail: NTIS HC A25/MF A01

N79-28128# Technische Hogeschool, Delft (Netherlands).
ADVANCED COMPUTER TECHNOLOGY IN AERODYNAMICS: A PROGRAM FOR AIRFOIL SECTION DESIGN UTILIZING COMPUTER GRAPHICS
J. L. vanIngen *In* Von Karman Inst. for Fluid Dyn. High Reynolds Number Subsonic Aerodyn. Apr. 1969 63 p refs (For primary document see N79-28119 19-01)
Avail: NTIS HC A25/MF A01

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N79-28158*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
POTENTIAL APPLICATIONS OF ADVANCED AIRCRAFT IN DEVELOPING COUNTRIES
Dal V. Maddalon Jul. 1979 43 p refs
(NASA-TM-80133) Avail: NTIS HC A03/MF A01 CSCL 01C

Air transportation concepts for movement of cargo in developing countries are reviewed using aicraft which may appear in the future. For certain industrial applications, including mining and forestry, the relative costs of doing the job using different types of aircraft are compared with surface transportation systems. Two developing countries, Brazil and Indonesia, were taken as examples to determine what impact they might have on the aircraft markets of the future. Economic and demographic data on developing countries in general, and Brazil and Indonesia in particular, are reviewed. The concept of an industrial city in a remote area developed around an airport is discussed. It is noted that developing areas generally lack extensive surface transportation systems and that an air transportation system can be implemented in a relatively short time. A developing nation interested in rapid expansion may thus find the role of air cargo far more important than has been true in developed nations. Technological developments which may dramatically increase the performance of agricultural aircraft are also reviewed. Author

N79-28159# Civil Aeromedical Inst., Oklahoma City, Okla.
ACOUSTIC SIGNALS FOR EMERGENCY EVACUATION
Jerry V. Tobias and Gerald D. Kidd, Jr. (Purdue Univ.) Jan. 1979 25 p refs
(AD-A066113; FAA-AM-79-5) Avail: NTIS HC A02/MF A01 CSCL 01/2

Tests were run using speech recordings at the exits of the FAA Civil Aeromedical Institute's emergency evacuation simulator. The voices called out, 'exit here', 'this way', and 'this way out', and people who had the opportunity to listen to them in an evacuation situation in which the illumination level was quite low and the subjects' vision was further obscured as if by smoke or dust performed better than people who did not hear the sounds. J.M.S.

N79-28160# Civil Aeromedical Inst., Oklahoma City, Okla.
INJURIES IN AIR TRANSPORT EMERGENCY EVACUATIONS
Donell W. Pollard Feb. 1979 32 p refs
(AD-A069372; FAA-AM-79-6) Avail: NTIS HC A03/MF A01 CSCL 01/2

Twelve air transport evacuations are reviewed. Injuries are discussed with emphasis on configurational and procedural

contributing factors. Recommendations and information about possible methods of reducing injuries are provided. Author

N79-28161# University of Northern Illinois, De Kalb. Dept. of Biological Sciences.
DEVELOPMENT OF COMPUTER-GENERATED PHENOGRAMS TO FORECAST REGIONAL CONDITIONS HAZARDOUS TO LOW-FLYING AIRCRAFT Interim Report, 30 Sep. 1977 - 30 Sep. 1978
William E. Southern 15 Nov. 1978 219 p refs
(Grant AF-AFOSR-3431-77; AF Proj. 2312)
(AD-A068812; AFOSR-79-0611TR) Avail: NTIS HC A10/MF A01 CSCL 01/2

The seasonal distribution of all North American gull species as derived from banding data and Christmas Bird Count reports is presented. The proportion of each month's gull population is shown for 6 square Zones designated by latitude and longitude. The number of birds present per Zone is plotted therein according to Quadrants (=1/4 Zone). USAF bird strikes occurring during 1974-1977 also are mapped for comparison. This preliminary summary of gull distribution and strike data can be used to identify when and where gulls may be presenting a significant hazard to low-flying aircraft. Application of the information during flight planning could reduce the number of strikes caused by gulls. Continuing studies will attempt to refine the application of such bird data to predict hazard levels to aircraft. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N79-28162 Ohio State Univ., Columbus.
A STUDY OF ALTIMETER-CONTROLLED TERRAIN-FOLLOWING SYSTEMS Ph.D. Thesis
Donald Morris Sovine 1979 210 p
Avail: Univ. Microfilms Order No. 7916028

The probability of crashing (or clobbering), of P sub c was estimated. The techniques for the estimation of P sub c are accurate when applied to a linear vehicle with synthetically generated terrain as an input. When both real and simulated terrain is the input to a nonlinear vehicle model, the results are similar; however, occasionally large errors occur that are not predicted by the theory. Similar errors are also apparent when real terrain is the input to the linear vehicle model, an indication that anomalous terrain behavior as well as certain characteristics of the limiters may be pronounced contributors to P sub c. It is concluded that the theory is an excellent tool for system design but that an alternate technique is desirable for accurate selection of the required clearance altitudes for an actual flight vehicle. Dissert. Abstr.

N79-28163# National Aviation Facilities Experimental Center, Atlantic City, N. J.
PROCEEDINGS OF THE WORLD-WIDE OMEGA DATA BANK CONFERENCE
Apr. 1979 168 p refs Conf. held at Philadelphia, Pa., 2-3 Aug. 1978 Conducted by NAFEC
(AD-A069474; FAA-NA-79-165; ANA-330) Avail: NTIS HC A08/MF A01 CSCL 17/7

Representatives of U.S. Government regulatory agencies, domestic and foreign avionics industries, and the scheduled and nonscheduled airlines both international and domestic participated in a conference called to: (1) discuss the requirement for and feasibility of establishing an Omega data bank as a depository for data illustrative of Omega propagation; (2) to outline the resources available, general plan of operation and conditions for participation by interested organizations; and (3) to complete plans for operation of this cooperative international venture. The concept, basis of the requirements, and background are explained and the technical presentation, comments, and suggestions about facilitating the deployment of in-flight data recorders, and the retrieval, processing, and analysis, and proposed distribution of data are included. A.R.H.

N79-28164*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE REFSAT APPROACH TO LOW-COST GPS TERMINALS
J. W. Sennott, A. K. Choudhury, and R. E. Taylor Apr. 1979 37 p refs Submitted for publication
(NASA-TM-79655) Avail: NTIS HC A03/MF A01 CSCL 17G

A concept utilizing a geostationary reference satellite (REFSAT) that broadcasts navigation aiding signals to low cost civil user terminals which employ the constellation of 24 NAVSTAR Global Positioning System (GPS) satellites for position determination is described. The signal acquisition, tracking and position fixing properties of such low cost, dual channel, L-band, civil user receiver designed to receive both GPS navigation and REFSAT navigation aiding signals is presented. REFSAT reduces the cost of user equipment. S.E.S.

N79-28165# Naval Air Rework Facility, Norfolk, Va.
PACIFIC AREA EVALUATION OF A COMMERCIAL OMEGA NAVIGATION SYSTEM INSTALLED IN A VC-118 AIRCRAFT, SUPPLEMENT 1
Clifton G. Wrestler, Jr. 10 Apr. 1979 9 p
(AD-A068106; NARF-C-118-WSM-1-78-Suppl-1) Avail: NTIS HC A02/MF A01 CSCL 17/7

A supplemental evaluation was deemed necessary for the Pacific Area due to variations in the geographic locations and power output of the ground based transmitters. GRA

N79-28166# Army Engineer Topographic Labs., Fort Belvoir, Va.
ANALYSIS, STORAGE, AND RETRIEVAL OF ELEVATION DATA WITH APPLICATIONS TO IMPROVE PENETRATION Research Note
Allen Klinger Mar. 1979 21 p refs
(AD-A068747; ETL-0179) Avail: NTIS HC A02/MF A01 CSCL 17/7

A method to use terrain elevation data for guidance is presented. Tree structure representation of contour trend data over regions is the basis of the method. Regions of different sizes obtained by quartering given elevation matrices are used; region size corresponds to tree position. Two computer functions are discussed: analysis methods to use tree-structured contour-trend information, suitable for onboard inflight computations; and storage reduction methods to present elevation data as a new digital mapping product (tree-structured contour-trend data), computable off-line on the USAETL Computer Sciences Laboratory STARAN array processor. Six figures detailing the analytic and data storage concepts discussed are given. An example illustrating the improved penetration possible from these methods is presented. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N79-28167*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
AIFTDS STAND-ALONE RMDU FLIGHT TEST REPORT
Douglas O. Wilner Jul. 1979 63 p
(NASA-TM-72866; H-1099) Avail: NTIS HC A04/MF A01 CSCL 01C

The remote multiplexer/digitizer unit for the airborne integrated flight test data system was subjected to a flight test environment in order to study its dynamic response and that of its associated instrumentation circuitry during an actual flight test. The shielding schemes and instrumentation used are described and the data obtained are analyzed. A.R.H.

N79-28168*# McDonnell-Douglas Corp., St. Louis, Mo.
HYPERSONIC AIRFRAME STRUCTURES: TECHNOLOGY NEEDS AND FLIGHT TEST REQUIREMENTS Final Report
J. E. Stone and L. C. Koch Jul. 1979 134 p refs
(Contract NAS1-14924)
(NASA-CR-3130; MDC-A4839) Avail: NTIS HC A07/MF A01 CSCL 01C

Hypersonic vehicles, that may be produced by the year 2000, were identified. Candidate thermal/structural concepts that merit consideration for these vehicles were described. The current status of analytical methods, materials, manufacturing techniques, and conceptual developments pertaining to these concepts were reviewed. Guidelines establishing meaningful technology goals were defined and twenty-eight specific technology needs were identified. The extent to which these technology needs can be satisfied, using existing capabilities and facilities without the benefit of a hypersonic research aircraft, was assessed. The role that a research aircraft can fill in advancing this technology was discussed and a flight test program was outlined. Research aircraft thermal/structural design philosophy was also discussed. Programs, integrating technology advancements with the projected vehicle needs, were presented. Program options were provided to reflect various scheduling and cost possibilities. R.E.S.

N79-28169# Bell-Northern Research Ltd., Ottawa (Ontario).
ELECTROMAGNETIC COMPATIBILITY (EMC) INVESTIGATION ON CH147 CHINOOK HELICOPTER
R. R. Goulette and K. E. Felske Jan. 1979 54 p
(Contract DNF-2pb77-00186; AETE Proj. 77/16-4)
(Rept-5J30-4479-02; DSS-3PB-2127662) Avail: NTIS HC A04/MF A01

The findings of the electromagnetic compatibility investigation performed on the CH147 Chinook helicopter, fitted with a high intensity anticollision strobe light, a crash position indicator, and an Omega navigation system are presented. R.E.S.

N79-28170# United Technologies Corp., Stratford, Conn. Sikorsky Aircraft Div.
ESTABLISHMENT OF MANUFACTURING METHOD AND TECHNOLOGY FOR THE FABRICATION OF HELICOPTER MAIN ROTOR BLADE SPARS BY CONTINUOUS SEAM DIFFUSION BONDING TITANIUM SHEET MATERIAL Final Report, 1 Oct. 1975 - 30 Sep. 1978
Maron J. Bonassar and John L. Lucas Nov. 1978 169 p refs
(Contract DAAG46-76-C-0016)
(AD-A067590; SER-510010; AVRADCOM-TR-79-5; AMMRC-TR-78-50) Avail: NTIS HC A08/MF A01 CSCL 13/8

This report summarizes a series of U.S. Army sponsored Manufacturing Methods and Technology, MM and T programs which were ultimately aimed at evaluating and implementing into production the use of the Continuous Seam Diffusion Bonding, CSDB, process to fabricate reliable, lower cost titanium alloy 6Al-4V helicopter main rotor blade spars. The current production process for manufacturing the UH-60A Army Black Hawk helicopter main rotor blade spars uses a plasma arc weld to join a cold brake formed cylindrical shape titanium sheet pre-form. The titanium pre-form is subsequently creep formed to the required final contour. The subject program has investigated and fabricated various shape spar pre-forms and manufacturing operations that could be easily cold brake formed from flat titanium sheet material into a configuration that is capable of being continuous seam diffusion bonded and subsequently creep formed to the final contour. Tooling which is capable of clamping and satisfactorily bonding the selected configuration pre-form shape has been designed and constructed. Process parameters relating to bonding variables and material condition have been evaluated. The subject program has successfully diffusion bonded three, ten foot length BLACK HAWK spar tubes, and non-destructively inspected, NDI, ten bonded spar tubes for any abnormalities. GRA

N79-28171# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
INTERNAL/EXTERNAL LIGHTING (AVIATION MATERIEL) Final Report
Oct. 1978 33 p refs Supersedes MTP-7-3-527
(AD-A068951; TOP-7-3-527; MTP-7-3-527) Avail: NTIS HC A03/MF A01 CSCL 01/3

This TOP establishes the procedure to conduct a developmental test of an internal and/or external lighting system as well as illumination test of a single or multiple instruments set or any other special purpose light or lights associated with the aircraft operational capability or crew performance, including troop and cargo compartment lighting. The aircraft light or lighting system will be operated during all applicable aircraft operational phases and assessed under all applicable atmospheric and climatic conditions representative of the operational environment the aircraft is expected to see within its operational theater. The primary objectives of this TOP are: (1) to determine if the designated light or lighting system performs its intended function in accordance with the requirements presented in the applicable approved documents; Letter of Requirement (LR), Letter of Agreement (LOA), Required Operational Characteristics (ROC), etc., as reflected through the detailed Test Design Plan (TDP); (2) to establish any detrimental or compromising side effects; (3) to insure human factors criteria have been met; and (4) to determine if the designated light or lighting system conforms to the applicable military specifications and/or standards as well as system specifications. GRA

N79-28172# Lockheed Missiles and Space Co., Sunnyvale, Calif.
AQUILA REMOTELY PILOTED VEHICLE SYSTEM TECHNOLOGY DEMONSTRATOR RPV-STD PROGRAM. VOLUME 1: SYSTEM DESCRIPTION AND CAPABILITIES Final Report, Dec. 1974 - Dec. 1977
Grover L. Alexander Apr. 1979 359 p refs
(Contract DAAJ02-75-C-0005; DA Proj. 1S7-63725-DK-61)
(AD-A068345; LMSC-D458287-Vol-1; USARTL-TR-78-37A)
Avail: NTIS HC A16/MF A01 CSCL 01/3

The Army Aquila RPV system technology demonstrator consists of 146 -lb RPVs with a 12.35 ft wingspan and a 6 ft length, ground support systems consisting of truck-mounted ground control stations and pneumatic launchers, trailer-mounted vertical barrier RPV retrieval systems, and auxiliary support equipment. The system demonstrated effective targeting and surveillance capabilities at maximum ranges exceeding 20 km, with payload options ranging from unstabilized TV cameras to laser desig:.ators. GRA

N79-28173# Lockheed Missiles and Space Co., Sunnyvale, Calif.
AQUILA REMOTELY PILOTED VEHICLE SYSTEM TECHNOLOGY DEMONSTRATOR RPV-STD PROGRAM. VOLUME 2: SYSTEM EVOLUTION AND ENGINEERING TESTING Final Report, Dec. 1974 - Dec. 1977
Grover L. Alexander Apr. 1979 322 p refs
(Contract DAAJ02-75-C-0005; DA Proj. 1S7-63725-DK-61)
(AD-A068346; LMSC-D458287-Vol-2; USARTL-TR-78-37B)
Avail: NTIS HC A15/MF A01 CSCL 01/3

The Aquila system was developed using off-the-shelf hardware and best commercial practices where practical to minimize cost while retaining performance commensurate with 'HI-REL' hardware design. Evolution of proven RPV concepts, i.e., autopilot, sensor, and pneumatic launcher; development of new elements, airframe structure, servoactuator, and electronic interface units; adaptation of such hardware as the data link elements; and use of existing commercial units, i.e., recorders, computer, and monitor hardware, produced an effective system that was refined through flight testing and made available to trained army crews. GRA

N79-28174# ARO, Inc., Arnold Air Force Station, Tenn.
STORE SEPARATION TESTING TECHNIQUES AT THE ARNOLD ENGINEERING DEVELOPMENT CENTER. VOLUME 3: DESCRIPTION AND VALIDATION OF CAPTIVE TRAJECTORY STORE SEPARATION TESTING IN THE VON KARMAN FACILITY Final Report, 1 Oct. 1977 - 25 May 1978
J. P. Billingsley, R. H. Burt, and J. T. Best Mar. 1979 93 p refs
(AD-A068319; AEDC-TR-79-1-Vol-3) Avail: NTIS HC A05/MF A01 CSCL 01/3

Tests were conducted on a four-finned, ogive-cylinder store model which was mounted on the von Karman Gas Dynamics Facility (VKF) Captive Trajectory System (CTS) in the Arnold Engineering Development Center (AEDC) Supersonic Wind

Tunnel A. The purpose of these tests was to provide information necessary for an independent check on the VKF CTS trajectory mode results. Grid and trajectory data were obtained for the store, both in the free stream and in the interference flow field, of a generalized parent-aircraft model. The Mach number was 1.63, with Reynolds numbers per foot of 5.0 and 3.8 million. Grid data from these tests were used in conjunction with the Air Force Flight Dynamics Laboratory (AFFDL) Six-Degree-of-Freedom Computer Program (SDFCP) to simulate the trajectories obtained by the VKF CTS. These SDFCP simulations compared favorably with the CTS trajectories, providing an important independent verification of the VKF CTS trajectory mode results. This report documents this validation effort and provides a general description of the VKF CTS as well as guidelines for potential users of this system. GRA

N79-28120# Lockheed-Georgia Co., Marietta.
ADVANTAGES AND PROBLEMS OF LARGE SUBSONIC AIRCRAFT
B. H. Little, Jr. *In* Von Karman Inst. of Fluid Dyn. High Reynolds Number Subsonic Aerodyn. Apr. 1969 30 p refs (For primary document see N79-28119 19-01)
Avail: NTIS HC A25/MF A01

N79-28125# Lockheed-Georgia Co., Marietta.
WING DESIGN, BODY DESIGN, HIGH LIFT SYSTEMS AND FLYING QUALITIES WITH INTRODUCTION
D. Ryle *In* Von Karman Inst. for Fluid Dyn. High Reynolds Number Subsonic Aerodyn. Apr. 1969 286 p (For primary document see N79-28119 19-01)
Avail: NTIS HC A25/MF A01

N79-28126# Lockheed-Georgia Co., Marietta.
ADVANCED COMPUTER TECHNOLOGY IN AERODYNAMICS. LECTURE 1: COMPUTER-AIDED AIRCRAFT DESIGN
B. H. Little, Jr. *In* Von Karman Inst. for Fluid Dyn. High Reynolds Number Subsonic Aerodyn. Apr. 1969 37 p refs (For primary document see N79-28119 19-01)
Avail: NTIS HC A25/MF A01

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N79-28175# Calspan Corp., Buffalo, N. Y.
AN EXPERIMENTAL INVESTIGATION OF CONTROL-DISPLAY REQUIREMENTS FOR A JET-LIFT VTOL AIRCRAFT IN THE TERMINAL AREA Final Report, Jun. 1976 - Jul. 1978
J. V. Lebacqz, R. C. Radford, and J. L. Beilman Jul. 1978 399 p refs
(Contract N62269-76-C-0370)
(AD-A068818; CALSPAN-AK-5985-F-1) Avail: NTIS HC A05/MF A01 CSCL 01/3

The fourth flight research program using the variable stability, variable display X-22A VTOL research aircraft was undertaken with the objective of expanding the operational capability of VTOL aircraft under adverse weather conditions. The experiment investigated a matrix of control, display and task variables for the landing approach task in a ground simulation phase followed by an in-flight simulation phase. Aerodynamic characteristics of the McDonnell-Douglas AV-8B Advanced Harrier were simulated for a prescribed decelerating approach profile using the X-22A's variable stability system; around this simulation, an analog of the AV-8B control system was implemented to investigate a range of realizable control system designs. Combinations of these control concepts and a variety of head-up display formats and information levels were evaluated in fight for simulated instrument approaches. GRA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N79-28176*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A THROAT-BYPASS STABILITY-BLEED SYSTEM USING RELIEF VALVES TO INCREASE THE TRANSIENT STABILITY OF A MIXED-COMPRESSION INLET
George H. Neiner, Miles O. Dustin, and Gary L. Cole Jul. 1979 47 p refs
(NASA-TP-1083; E-8950) Avail: NTIS HC A03/MF A01 CSCL 21E

A stability-bleed system was installed in a YF-12 flight inlet that was subjected to internal and external airflow disturbances in the NASA Lewis 10 by 10 foot supersonic wind tunnel. The purpose of the system is to allow higher inlet performance while maintaining a substantial tolerance (without unstart) to internal and external disturbances. At Mach numbers of 2.47 and 2.76, the inlet tolerance to decreases in diffuser-exit corrected airflow was increased by approximately 10 percent of the operating-point airflow. The stability-bleed system complemented the terminal-shock-control system of the inlet and did not show interaction problems. For disturbances which caused a combined decrease in Mach number and increase in angle of attack, the system with valves operative kept the inlet started 4 to 28 times longer than with the valves inoperative. Hence, the stability system provides additional time for the inlet control system to react and prevent unstart. This was observed for initial Mach numbers of 2.55 and 2.68. For slow increase in angle of attack at Mach 2.47 and 2.76, the system kept the inlet started beyond the steady-state unstart angle. However, the maximum transient angles of attack without unstart could not be determined because wind-tunnel mechanical-stop limits for angle of attack were reached. A.R.H.

N79-28177*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF ROTOR MERIDIONAL VELOCITY RATIO ON RESPONSE TO INLET RADIAL AND CIRCUMFERENTIAL DISTORTION
Nelson L. Sanger Jul. 1979 73 p refs
(NASA-TP-1278; E-8987) Avail: NTIS HC A04/MF A01 CSCL 21E

Three single transonic fan stages, each having a different meridional velocity ratio across its rotor, were tested with two magnitudes of tip radial distortion and with a 90 deg circumferential distortion imposed on the inlet flow. The rotor with the lowest meridional velocity ratio (less than 0.9 at the tip) demonstrated the least degradation of performance due to these distortions. Loss and deviation angle data (as needed for performance prediction with radial distortion) calculated along actual streamlines for radially distorted flow and correlated against diffusion factor, showed consistent agreement with data calculated along design streamlines for undistorted flow. Author

N79-28178# Monsanto Research Corp., Dayton, Ohio.
JET ENGINE EXHAUST ANALYSIS BY SUBTRACTIVE CHROMATOGRAPHY Final Report, 1 Mar. 1977 - 24 Jul. 1978
Joseph J. Brooks, Diana S. West, John E. Strobel, and Leonard Stamper Dec. 1978 77 p refs
(Contract F33615-77-C-0616)
(AD-A067898; MRC-DA-839; SAM-TR-78-37) Avail: NTIS HC A05/MF A01 CSCL 21/2

This report describes the further refinement of a method for the sampling and analysis of organics in jet engine exhaust by chemical classes. Details for the selection, construction, and evaluation of the combination sorbent (Tenax-GC/Ambersorb XE-340) sampling system are given along with the rationale and operational parameters for the subtractive chromatography

system that produces the organic class analysis. The significant improvements incorporated into both the sampling and analytical systems compared with previous systems used in a jet engine exhaust study of March 1975 are discussed. The capabilities of the system are illustrated by the analysis of actual jet engine exhaust samples from a J85-5 engine using JP-4 and an alternate fuel blend that simulates the higher aromatic content expected from shale and coal-derived fuels. Author (GRA)

N79-28179# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
BUILD 1 OF AN ACCELERATED MISSION TEST OF A TF41 WITH BLOCK 76 HARDWARE Final Report, 18 Oct. 1977 - 13 Jan. 1978
Robert J. May, Jr., Donald P. Mcerlean, and Doretta Holland Mar. 1979 191 p refs
(AD-A068595; AFAPL-TR-79-2020) Avail: NTIS HC A09/MF A01 CSCL 21/5

An accelerated mission test (AMT) of a TF41 (S/N 142163) was conducted in the Air Force Aero Propulsion Laboratory's 'D' bay sea level engine test facility between 18 Oct 77 and 13 Jan 78. The primary objective of the test was to evaluate the structural reliability of a series of parts changes known as 'Block 76' hardware under realistic usage conditions. A two hundred sixty three hour test program was initially planned but only one hundred and six hours were actually completed due to the failure of a second stage high pressure turbine blade. The second stage turbine had been reworked and the verification of this rework scheme was a secondary objective of this test. The failure occurred at a reworked location but the actual cause of failure could not be determined. The post-test teardown inspection showed all of the Block 76 hardware to be in good condition. GRA

N79-28180# Solar Turbines International, San Diego, Calif.
EFFECTS OF GAS TURBINE COMBUSTION ON SOOT DEPOSITION Final Report, 15 Oct. 1977 - Mar. 1979
D. J. White Mar. 1979 58 p refs
(Contract N00014-78-C-0003)
(AD-A068491; SR79-R-4643-03; Rept-6-4643-7) Avail: NTIS HC A04/MF A01 CSCL 21/2

The effects of premixing the reaction air and fuel of a gas turbine combustor on soot formation were investigated. Other parameters such as pressure, temperature and reaction zone fuel-air ratio were also evaluated. Soot formation was found to be dominated by fuel-air premixing and could be suppressed readily through a partial premix process. GRA

N79-28181# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
TECHNICAL EVALUATION REPORT ON THE 52ND SYMPOSIUM OF THE PROPULSION AND ENERGETICS ON STRESSES, VIBRATIONS, STRUCTURAL INTEGRATION AND ENGINE INTEGRITY (INCLUDING AEROELASTICITY AND FLUTTER)
L. Beitch (Gen. Elec. Co., Evandale, Ohio) Mar. 1979 12 p refs Symp. held in Cleveland, Ohio, 23-27 Oct. 1978
(AGARD-AR-133; ISBN-92-835-1314-2) Avail: NTIS HC A02/MF A01

A wide spectrum of topics associated with engine development, engine-aircraft integration, and engine operation were addressed. M.M.M.

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N79-28182 California Univ., Los Angeles.
IDENTIFICATION OF AIRCRAFT PARAMETERS IN TURBULENCE WITH NON-RATIONAL SPECTRAL DENSITY Ph.D. Thesis
Frank Chu-Chun Tung 1979 171 p
Avail: Univ. Microfilms Order No. 7915685

Aircraft turbulence was modeled with the von Karman spectrum in an attempt to improve the aircraft parameter estimation method. A new identification technique was introduced to handle linear systems with non-rational transfer functions, and the associated numerical methods were also developed. This new technique was then applied to both simulated and actual flight test data. Dissert. Abstr.

N79-28183 Illinois Univ. at Urbana-Champaign.
EFFECT OF ATMOSPHERIC TURBULENCE ON THE STABILITY OF A LIFTING ROTOR BLADE Ph.D. Thesis
Yoshinori Fujimori 1978 200 p
Avail: Univ. Microfilms Order No. 7913462

Motion stability of a lifting rotor blade operating in a turbulent flow is investigated. A new procedure is developed in which use is made of the Markov process theory and numerical solution of the Floquet transition matrix and its eigenvalues. The basic differential equations governing the flap, flap-torsion and flap-leadlag motions are first linearized and then converted into corresponding stochastic differential equations in the sense of Ito. For simplicity, all parametric excitations are assumed to be of the white noise type with constant spectral densities. The equations for the first and second moments are derived from the Ito equations. Since both the first and second moment equations are differential equations with periodic coefficients, the stability boundary in each case is found by a numerical search involving the determination of the Floquet transition matrix and its eigenvalues. Numerical examples are given to illustrate the application of the theory. Dissert. Abstr.

N79-28184 Purdue Univ., Lafayette, Ind.
AN EXPERIMENTAL STUDY OF THE FLAPPING MOTION OF A TURBULENT PLANE JET Ph.D. Thesis
Jaime Gonzalo CervantesDeGortari 1978 168 p
Avail: Univ. Microfilms Order No. 7914881

The technique employed in the measurements of the turbulence effects on the flapping motion was to compute crosscorrelation functions between the velocity fluctuations (one delayed in time) in the longitudinal direction, at two points on opposite sides of the jet. Standard hot-wire anemometry and on-line digital processing instrumentation were used. Four types of measurements were performed: (1) with the probes symmetrically positioned with respect to the centerline of the jet; (2) with the probes asymmetrically set with respect to the centerline; (3) with the probes at points of different longitudinal coordinate; and (4) with an x-wire at the centerline of the jet where the autocorrelation of the lateral component of the velocity was measured. Dissert. Abstr.

N79-28185 Ohio State Univ., Columbus.
THEORY, DESIGN AND EXPERIMENTAL STUDY OF AN EDDY-CURRENT/HYDROMECHANICAL STABILITY AUGMENTOR FOR AIRCRAFT Ph.D. Thesis
Gavin Dale Jenney 1979 248 p
Avail: Univ. Microfilms Order No. 7915991

The hydromechanical eddy-current coupler mechanization described consists of an inertial reference, an eddy-current coupler, and a hydraulic actuator controlled by a flapper-nozzle hydraulic control stage. The inertial reference incorporates permanent magnets mounted on a support disc which is pivoted with instrument bearings at its geometric center. The magnets are the principal mass of the inertial reference. The calculations and experimental test results used for the design of the experimental unit are presented. The unit was tested at 80 F and -40 F fluid temperatures and met the objectives of providing the desired performance with less hydraulic flow. The total actuator weight and size are equivalent to or less than prior mechanizations. Dissert. Abstr.

N79-28186*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PREDICTING DYNAMIC PERFORMANCE LIMITS FOR SERVOSYSTEMS WITH SATURATING NONLINEARITIES
John A. Webb, Jr. and Richard A. Blech Jul. 1979 52 p refs (NASA-TP-1488; E-9903) Avail: NTIS HC A04/MF A01 CSCL 01C

A generalized treatment for a system with a single saturating nonlinearity is presented and compared with frequency response

plots obtained from an analog model of the system. Once the amplitude dynamics are predicted with the limit lines, an iterative technique is employed to determine the system phase response. The saturation limit line technique is used in conjunction with velocity and acceleration limits to predict the performance of an electro-hydraulic servosystem containing a single-stage servovalve. Good agreement was obtained between predicted performance and experimental data. S.E.S.

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N79-28187# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Geotechnical Lab.

DEVELOPMENT OF A STRUCTURAL DESIGN PROCEDURE FOR RIGID AIRPORT PAVEMENTS Final Report, 1975 - 1978

Frazier Parker, Jr., Walter R. Barker, Robert C. Gunkel, and Eugene C. Odom Apr. 1979 299 p refs

(Contract DOT-FA73WAI-377; DA Proj. 4A1-61102-B-52E)

(AD-A069548; WES-TR-GL-79-4; FAA-RD-77-81) Avail: NTIS HC A13/MF A01 CSCL 01/5

The development and formulation of a design procedure for rigid airport pavements are presented. The design criteria used in the procedure are based on the tensile stress in the portland cement concrete (PCC) slab as computed by layered elastic theory and the strength of the PCC slab as measured in the flexural beam test. The criteria were developed by the analysis of some 60 test sections. Procedures are given for the characterization of the pavement materials both by laboratory testing and by typical values and/or correlation studies. The thickness requirements as determined by the new criteria are compared with the thickness as determined by present Corps of Engineers-Federal Aviation Administration design procedures. Author

N79-28188# Federal Aviation Administration, Washington, D. C. Office of Management Systems.

FAA AIR TRAFFIC ACTIVITY, FISCAL YEAR 1978

Patricia Wilson 30 Sep. 1978 238 p

(AD-A067910) Avail: NTIS MF A01; HC SOD $4.50 CSCL 01/2

This report furnishes terminal and enroute air traffic activity information of the National Airspace System. The data have been reported by the FAA-operated Airport Traffic Control Towers (ATCTs), Air Route Traffic Control Centers (ARTCCs), Flight Service Stations (FSSs), Combined Station Towers (CS/Ts), International Flight Service Stations (IFSSs), and Approach Control Facilities. Author (GRA)

N79-28189# Air Force Engineering and Services Center, Tyndall AFB, Fla. Engineering and Services Lab.

INTERIM FIELD PROCEDURE FOR BOMB DAMAGE REPAIR USING CRUSHED LIMESTONE FOR CRATER REPAIRS AND SILIKAL TRADE NAME FOR SPALL REPAIRS Interim Report, Jun. 1978 - Mar. 1979

Michael T. McNerney Apr. 1979 52 p refs

(AF Proj. 2104)

(AD-A068617; AFESC/ESL-TR-79-01) Avail: NTIS HC A04/MF A01 CSCL 19/4

This report describes a recommended procedure for performing repairs of large and small bomb craters using crushed stone as the repair material. The report also describes a rapid spall repair technique using a proprietary polymer concrete product. The repair techniques are described to determine the equipment, manpower, and time required to affect repairs. The report gives a brief description of the results of field tests using the crushed stone and polymer concrete techniques. GRA

N79-28190# General Accounting Office, Washington, D. C. Community and Economic Development Div.

DEVELOPING A NATIONAL AIRPORT SYSTEM: ADDITIONAL CONGRESSIONAL GUIDANCE NEEDED Report to the Congress

17 Apr. 1979 75 p refs

(PB-294082/3; CED-79-17) Avail: NTIS HC A04/MF A01 CSCL 01E

In the next decade, over $10 billion will be needed to develop a national airport system. Of this, about $3 billion is needed to develop some 2,600 general aviation airports to serve business and pleasure flying. Additional congressional guidance is needed to help identify general aviation airports essential to a national airport system. State and local airport planning financed with Federal grants was to support development of the national airport system; this has not occurred. Federal legislation should be enacted to require State and local airport plans as a prerequisite for Federal airport development grants. Sufficient grant funds have not been available to finance airport improvements. The existing method for funding such improvements has not been effective in implementing a national airport system. The Congress should establish priorities for distributing Federal airport development grants. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N79-28191# Committee on Science and Technology (U. S. House).

OVERSIGHT: PRESIDENT'S CIVILIAN SPACE POLICY

Washington GPO 1979 69 p Hearing before the Comm. on Sci. and Technol., 96th Congr., 1st Sess., 14 Feb. 1979

(GPO-44-319) Avail: Comm. on Sci. and Technol.

Testimony was given on the contents of the president's view on the future of space programs. A clarification on the nature and scope of the administraton's space policy was reported. Some of the space programs discussed were: space shuttles, LANDSAT satellites, earth resource allocations, and environmental monitoring. M.M.M.

N79-28192*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

EARLY SPACE EXPERIMENTS IN MATERIALS PROCESSING

Robert J. Naumann Jul. 1979 323 p

(NASA-TM-78234) Avail: NTIS HC A14/MF A01 CSCL 22A

A comprehensive survey of the flight experiments conducted in conjunction with the United States Materials Processing in Space Program is presented. Also included are a brief description of the conditions prevailing in an orbiting spacecraft and the research implications provided by this unique environment. What was done and what was learned are summarized in order to serve as a background for future experiments. It is assumed that the reader has some knowledge of the physical sciences but no background in spaceflight experimentation or in the materials science per se. For individual titles, see N79-28193 through N79-28200.

N79-28193*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

THE PROMISE OF SPACE PROCESSING

In its Early Space Expt. in Mater. Process. Jul. 1979 37 p

(For primary document see N79-28192 19-12)

Avail: NTIS HC A14/MF A01 CSCL 22A

The long exposure to a virtually zero-gravity environment is a truly unique situation that cannot be duplicated or even approximated for any length of time on earth. The topics discussed are: (1) low gravity; (2) atmospheric effects; (3) potential advantages of materials processing in space; (4) the absence of buoyancy-driven convection; (5) the absence of hydrostatic pressure; (6) the absence of sedimentation and buoyancy; (7) containerless processing; and (8) ultrahigh vacuum processing. G.Y.

N79-28194*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
POSSIBLE APPLICATIONS OF SPACE PROCESSING
In its Early Space Expt. in Mater. Process. Jul. 1979 60 p (For primary document see N79-28192 19-12)
Avail: NTIS HC A14/MF A01 CSCL 22A

Numerous applications take advantage of low gravity. These range from research, such as study of basic properties of materials or developing a better understanding of various processes and how they might be controlled, to actual production of unique materials, either in very limited quantities for research purposes to serve as paradigms for determining the limiting results of processes in which gravity effects are removed, or in large quantities, to fill certain high technology needs that cannot be met by other means. Examples of these are given in the following topics discussed: (1) crystal growth; (2) metals, alloys and composite materials (metallurgy); (3) glass and ceramics (containerless processing); (4) fluid and chemical processes; and (5) processing of biological materials. G.Y.

N79-28195*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE EVOLUTION OF APPARATUS FOR MATERIALS PROCESSING ON SKYLAB
In its Early Space Expt. in Mater. Process. Jul. 1979 48 p (For primary document see N79-28192 19-12)
Avail: NTIS HC A14/MF A01 CSCL 22A

The following topics are discussed: (1) the inception of space processing; (2) earth-based experimental activities prior to Skylab (drop tower and research aircraft experiments); (3) preliminary experiments in space (Apollo and sounding rocket experiments); and (4) Skylab experimental facilities. Apparatus for contained materials processing; for brazing in space; and containerless processing are presented and discussed. The Skylab materials processing system and miscellaneous design considerations are also discussed. G.Y.

N79-28196*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE PROCESSING OF SEMICONDUCTOR MATERIALS
In its Early Space Expt. in Mater. Process. Jul. 1979 45 p (For primary document see N79-28192 19-12)
Avail: NTIS HC A14/MF A01 CSCL 22A

Five experiments involving the processing of semiconductor materials were performed during the Skylab mission. After discussions on semiconductors and their unique electronic properties, and techniques of crystal growth, these five experiments are presented. Four melt growth experiments were attempted: (1) steady state growth and segregation under zero gravity (InSb); (2) seeded, containerless solidification of InSb; (3) influence of gravity-free solidification on microsegregation; and (4) directional solidification of InSb-GaSb alloys. One vapor growth experiment, crystal growth by vapor transport, was attempted. G.Y.

N79-28197*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METALLURGICAL PROCESSING
In its Early Space Expt. in Mater. Process. Jul. 1979 37 p (For primary document see N79-28192 19-12)
Avail: NTIS HC A14/MF A01 CSCL 11F

The metallurgical processing experiments on Skylab were chosen to: (1) elucidate the unknown effects of a low gravity environment on certain processes; (2) determine to what extent nongravitational driven flows operate in the processes; and (3) explore the possibilities of containerless solidification. Welding and brazing experiments were conducted to provide an understanding of solidification mechanics in a weightless environment. S.E.S.

N79-28198*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FLUID BEHAVIOR IN LOW g
In its Early Space Expt. in Mater. Process. Jul. 1979 33 p (For primary document see N79-28192 19-12)
Avail: NTIS HC A14/MF A01 CSCL 20D

Several experiments and a number of demonstrations were performed during Skylab to elucidate the behavior of fluids in space. The purposes of these experiments were to confirm hypotheses on how systems would behave in a low-g environment, determine to what extent residual accelerations and nongravity-driven convection affected processes, and provide graphic demonstrations of fluid behavior in space for classroom use and to stimulate new ideas for low-g research. Author

N79-28199*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
POST-SKYLAB ACTIVITIES
In its Early Space Expt. in Mater. Process. Jul. 1979 45 p (For primary document see N79-28192 19-12)
Avail: NTIS HC A14/MF A01 CSCL 22A

The Apollo Soyuz Test Program is described. A modification of the Skylab furnace was developed for the ASTP mission that had a maximum temperature of 1200 C, a programmed cool down to give more uniform growth rates, and a He quench system to shorten the time required to reach allowable touch temperature. The Space Processing Applications Rocket (SPAR) program was initiated to provide some continuity in flight experimentation. Liquid mixing, immiscible alloy solidification, composite materials, bubbles and dispersed particles during solidification, and containerless processing techniques were studied in the SPAR program. S.E.S.

N79-28200*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EARLY SPACE EXPERIMENTS IN MATERIALS PROCESSING: FUTURE PROGRAMS
In its Early Space Expt. in Mater. Process. Jul. 1979 16 p (For primary document see N79-28192 19-12)
Avail: NTIS HC A14/MF A01 CSCL 22A

A list of the present state of knowledge in materials processing is presented. The fluid behavior in a low gravity environment is summarized. Materials processing in the Space Transportation System facility is discussed. Prospects for space commercialization are reported. S.E.S.

N79-28201*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AUTONOMOUS MECHANICAL ASSEMBLY ON THE SPACE SHUTTLE: AN OVERVIEW
M. H. Raibert 15 Jul. 1979 34 p refs
(Contract NAS7-100)
(NASA-CR-158818; JPL-PUB-79-62) Avail: NTIS HC A03/MF A01 CSCL 22A

The space shuttle will be equipped with a pair of 50 ft. manipulators used to handle payloads and to perform mechanical assembly operations. Although current plans call for these manipulators to be operated by a human teleoperator. The possibility of using results from robotics and machine intelligence to automate this shuttle assembly system was investigated. The major components of an autonomous mechanical assembly system are examined, along with the technology base upon which they depend. The state of the art in advanced automation is also assessed. A.R.H.

N79-28202# Committee on Space Research (COSPAR), Paris (France).
SPACE RESEARCH ACTIVITIES IN THE GERMAN DEMOCRATIC REPUBLIC
W. Boehme, comp. and R. Knuth, comp. 1979 15 p refs Presented at 22d Meeting of COSPAR, Bangalore, India, 1979
Avail: NTIS HC A02/MF A01

Activities conducted at various research facilities in East Germany are reported. Major areas include: research, environmental physics, and satellite geodesy. R.E.S.

N79-28203*# National Aeronautics and Space Administration, Washington, D. C.
CHARIOTS FOR APOLLO: A HISTORY OF MANNED LUNAR SPACECRAFT
Courtney G. Brooks, James M. Grimwood, and Lloyd S. Swenson, Jr. 1979 553 p refs
(NASA-SP-4205) Avail: NTIS MF A01; SOD HC $9.00 CSCL 22B

Beginning with the challenges presented by Sputnik 1 in 1957, and the formation of NASA, the apollo lunar exploration program is reviewed through Apollo Flight 11. The focal points

are the spacecraft including the command and service modules, and the lunar module. F.O.S.

N79-28204*# Varian Associates, Palo Alto, Calif.
DEVELOPMENT PROGRAM FOR A 200 kW, TECHNOLOGICAL PROCESSES IN SPACE
H. Jory 1978 30 p refs Transl. into ENGLISH of "Teoreticheskiye Osnovy Provedeniya Nekotorykh Tekhnologicheskikh Protsessov v Kosmose", Rept. Pr - 435 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1978 p 1-29 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract W-7405-eng-26)
(ORNL/Sub-01617/10; QR-10; Pr-435) Avail: NTIS HC A03/MF A01 CSCL 22A

Dimensionless conservation equations, are presented and the theoretical basis of fluid behavior aboard orbiting satellites are reviewed with application to the processes of manufacturing crystals in weightlessness. The small amount of gravitational acceleration is shown to increase the separation of bands of varying concentration. Nautural convection is shown to have no practical effect on crystallization from realistic conductions of weightlessness. The effects of surface tension become increasingly large, and suggestions are made for further research. A.R.H.

N79-28205*# National Aeronautics and Space Administration, Washington, D. C.
THEORETICAL BASES FOR CONDUCTING CERTAIN TECHNOLOGICAL PROCESSES IN SPACE
A. S. Okhotin Jun. 1979 30 p refs Transl. into ENGLISH of "Teoreticheskiye Osnovy Provedeniya Nekotorykh Tekhnologicheskikh Protsessov v Kosmose", Rept. Pr-435 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1978 p 1-29 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75637; Pr-435) Avail: NTIS HC A03/MF A01 CSCL 22A

Dimensionless conservation equations are presented and the theoretical bases of fluid behavior aboard orbiting satellites with application to the processes of manufacturing crystals in weightlessness. The small amount of gravitational acceleration is shown to increase the separation of bands of varying concentration. Natural convection is shown to have no practical effect on crystallization from a liquid melt. Barodiffusion is also negligibly small in realistic conditions of weightlessness. The effects of surface tension become increasingly large, and suggestions are made for further research. A.R.H.

N79-28206*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
OPS MCC LEVEL B/C FORMULATION REQUIREMENTS: AREA TARGETS AND SPACE VOLUMES PROCESSOR
Mack J. Bishop, Jr. Jul. 1979 139 p ref
(NASA-TM-80485; Rept-79-FM-26; JSC-16029) Avail: NTIS HC A07/MF A01 CSCL 22A

The level B/C mathematical specifications for the area targets and space volumes processor (ATSVP) are described. The processor is designed to compute the acquisition-of-signal (AOS) and loss-of-signal (LOS) times for area targets and space volumes. The characteristics of the area targets and space volumes are given. The mathematical equations necessary to determine whether the spacecraft lies within the area target or space volume are given. These equations provide a detailed model of the target geometry. A semianalytical technique for predicting the AOS and LOS time periods is disucssed. This technique was designed to bound the actual visibility period using a simplified target geometry model and unperturbed orbital motion. Functional overview of the ATSVP is presented and it's detailed logic flow is described. R.E.S.

N79-28207# New Mexico Univ., Albuquerque. Technology Application Center.
THE SKYLAB PROGRAM, VOLUME 1. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1972 - Dec. 1974
Gerald F. Zollars Apr. 1979 46 p Sponsored in part by NTIS
(NTIS/PS-79/0335/4) Avail: NTIS HC $28.00/MF $28.00 CSCL 22A

Articles concerning Skylab mission planning, the Earth Resources Program, development of the Apollo telescope mount, remote sensing, orbital workshops, aerospace medicine, the SKYLAB Student science program, and early research results of of experiments performed aboard SKYLAB are reported. GRA

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N79-28208*# Analytical and Computational Mathematics, Inc., Houston, Tex.
APPLICATION AND ANALYSIS OF SATELLITE ORBIT PREDICTION TECHNIQUES
12 Apr. 1977 80 p refs Sponsored by NASA
(NASA-CR-157219; JSC-12571; Rept-77-FM-19) Avail: NTIS HC A05/MF A01 CSCL 03B

The numerical accuracy of a satellite orbit computation program was investigated. The effects of roundoff and truncation errors on the solution were determined. New formulations that have the mean motion based on the total energy are compared to the more classical formulations and evaluated via numerical experiments. M.M.M.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N79-28209# White Sands Missile Range, N.Mex. Instrumentation Directorate.
CHOOSING TELESCOPE SYSTEM MIX Final Report
B. D. Sivazlian and R. E. Green Dec. 1978 68 p refs
(DA Proj. 1T6-65804-DE-93)
(AD-A069098; STEWS-ID-78-4) Avail: NTIS HC A04/MF A01 CSCL 05/1

A method of choosing alternative mixes of instruments is presented. The mix of instruments is chosen based on total discounted cost for the life of the system. The optimum mix is chosen using linear programming techniques. The sample problem solved chooses the optimum mix of tracking telescopes for White Sands Missile Range. The information used for this analysis was collected in the summer of 1976. Author (GRA)

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N79-28210*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ORBITING DEEP SPACE RELAY STATION. VOLUME 3: IMPLEMENTATION PLAN Final Report
John A. Hunter 15 Jun. 1979 28 p refs
(Contract NAS7-100)
(NASA-CR-158817; JPL-Pub-79-30-Vol-3) Avail: NTIS HC A03/MF A01 CSCL 22B

An implementation plan for the Orbiting Deep Space Relay Station (ODSRS) is described. A comparison of ODSRS life cycle costs to other configuration options meeting future communication requirements is presented. R.E.S.

N79-28211*# Ohio State Univ. Research Foundation, Columbus.
ESTIMABILITY AND SIMPLE DYNAMICAL ANALYSES OF RANGE (RANGE-RATE RANGE-DIFFERENCE) OBSERVA-

TIONS TO ARTIFICIAL SATELLITES
Boudewijn H. W. VanGelder Dec. 1978 286 p refs
(Grant NsG-5265; OSURF Proj. 711055)
(NASA-CR-158843; Rept-284) Avail: NTIS HC A13/MF A01 CSCL 22A

Non-Bayesian statistics were used in simulation studies centered around laser range observations to LAGEOS. The capabilities of satellite laser ranging especially in connection with relative station positioning are evaluated. The satellite measurement system under investigation may fall short in precise determinations of the earth's orientation (precession and nutation) and earth's rotation as opposed to systems as very long baseline interferometry (VLBI) and lunar laser ranging (LLR). Relative station positioning, determination of (differential) polar motion, positioning of stations with respect to the earth's center of mass and determination of the earth's gravity field should be easily realized by satellite laser ranging (SLR). The last two features should be considered as best (or solely) determinable by SLR in contrast to VLBI and LLR. A.R.H.

N79-28212# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
TECHNICAL NOTES APT 78-4 [NOTA TECHNIA APT 78-4]
Marlene Elias Feb. 1979 14 p In PORTUGUESE
(INPE-1419-NTE/144) Avail: NTIS HC A02/MF A01

The trajectories of various meteorological satellites in polar orbits are reported along with infrared and microwave telemetry and an automatic picture transmission system.
Transl. by M.M.M.

N79-28213# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.
ENVIRONMENTAL FACTORS OF POWER SATELLITES Interim Report
Yam T. Chiu and Barbara K. Ching 6 Jul. 1979 49 p refs
(Contract F04701-78-C-0079)
(SAMSO-TR-79-66; TR-0079(4960-04)-5) Avail: NTIS HC A03/MF A01

All presently known factors in the construction and operation of the proposed solar power satellite which may produce effects on the environment from ground level to beyond the magnetopause are reviewed. Characteristics of the propulsion system exhausts of the space segment, the microwave beam, the satellite physical structure, and the HLLV launch and landing activities are described. A.R.H.

N79-28214# Martin Marietta Aerospace, Orlando, Fla.
AERODYNAMIC STABILITY TECHNOLOGY FOR MANEUVERABLE MISSILES. VOLUME 2: ASYMMETRIC VORTEX EFFECTS COMPUTER PROGRAM Final Report, Feb. 1975 - Dec. 1976
Gennaro F. Aiello and Michael C. Bateman Mar. 1979 96 p refs
(Contract F33615-75-C-3052)
(AD-A068971; OR-14028-Vol-2; AFFDL-TR-76-55-Vol-2) Avail: NTIS HC A05/MF A01 CSCL 16/4

A procedure for estimating the effects of asymmetric lee-side vortices on slender missile configurations with and without tails is developed, using both theoretical and empirical inputs. A computerized model of the procedure which calculates induced side forces, yawing moments, tail forces and rolling moments is presented. Program flow charts, input instructions and sample cases are provided. Comparisons between experiments data and program calculations show acceptable preliminary design level accuracies. GRA

N79-28215# Air Force Geophysics Lab., Hanscom AFB, Mass.
DEVELOPMENT OF PROXIMITY AND ELECTROSTATICALLY FOCUSED DIODES FOR UV MEASUREMENTS FROM SOUNDING ROCKETS Instrumentation Papers
S. L. Russak (Martin Marietta Corp., Denver), J. C. Flemming (Martin Marietta Corp., Denver), R. E. Huffman, D. E. Paulsen, and J. C. Larrabee 4 Jan. 1979 21 p refs
(AF Proj. 2123)
(AD-A068086; AFGL-TR-79-0006; AFGL-IP-275) Avail: NTIS HC A02/MF A01 CSCL 17/5

This report describes the development of two types of imaging digicon detectors for ultraviolet measurements from rockets. The detectors consist of sealed tubes with a semitransparent photocathode of cesium iodide or cesium telluride. Photoelectrons accelerated to about 25 kV are detected by a silicon diode array. One tube has a ten by ten square array with proximity focussing and is used to obtain spatial intensity measurements. The other tube has a one by thirty-six linear array that is placed in the focal plane of a spectrograph. The problems associated with construction of these devices are discussed. Laboratory test results demonstrating the use of these tubes are given. GRA

N79-28216# Naval Postgraduate School, Monterey, Calif.
COMPUTER SIMULATED DEVELOPMENT OF IMPROVED COMMAND TO LINE-OF-SIGHT MISSILE GUIDANCE TECHNIQUES M.S. Thesis
Frank F. Hewitt Mar. 1979 107 p refs
(AD-A068532) Avail: NTIS HC A06/MF A01 CSCL 17/7

Three computer simulations of command to line-of-sight missile guidance systems were developed within an electronic warfare environment to test the feasibility of improved guidance techniques while maintaining simplicity for generic application among the various missiles of this general guidance classification. The first simulation modeled the basic guidance scheme; the second introduced a 'lead-angle' concept; and the third simulation combined these techniques for use depending upon whether the target took evasive action or employed electronic countermeasures. It was found that consideration should be given for use of a 'lead-angle' variant in conjunction with the basic guidance technique to enhance the effective engagement envelope of these missile systems against relatively slower-maneuvering targets employing only low-duty-cycle denial jamming. GRA

N79-28217# New Mexico Univ., Albuquerque. Technology Application Center.
COMMUNICATIONS SATELLITE TECHNOLOGY, VOLUME 1, 1976. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1976
Gerald F. Zollars Apr. 1979 61 p Sponsored in part by NTIS
(NTIS/PS-79/0332/1-Vol-1) Avail: NTIS HC $28.00/MF $28.00 CSCL 17B

The 226 cited articles concern aspects of Communications Satellite Technology. Articles on satellite networks, time division multiplexing, satellite design, microwave transmission, ground stations, antennas, and domestic satellite communications systems are included. GRA

N79-28218# New Mexico Univ., Albuquerque. Technology Application Center.
COMMUNICATIONS SATELLITE TECHNOLOGY, VOLUME 2, 1977. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1977
Gerals F. Zollars Apr. 1979 60 p Sponsored in part by NTIS
(NTIS/PS-79/0333/9-Vol-2) Avail: NTIS HC $28.00/MF $28.00 CSCL 17B

The 238 cited articles concern aspects of Communications Satellite Technology. Articles on satellite transmission, networks, ground stations, domestic satellite communications sytems, synchronous satellites, and transmission efficiency are included. GRA

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N79-28219*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SPACE TRANSPORTATION SYSTEM PAYLOAD SAFETY GUIDELINES HANDBOOK
Jul. 1976 159 p
(NASA-TM-80421; JSC-11123) Avail: NTIS HC A08/MF A01 CSCL 22A

This handbook provides the payload developer with a uniform description and interpretation of the potential hazards which may be caused by or associated with a payload element, operation, or interface with other payloads or with the STS. It also includes guidelines describing design or operational safety measures which suggest means of alleviating a particular hazard or group of hazards, thereby improving payload safety. J.A.M.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N79-28220*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION PLANS FOR SPACE COMMUNICATION TECHNOLOGY
Robert E. Alexovich 1979 13 p refs Proposed for presentation at EASCON Session on Communications Satellite Technol., Washington, D. C., 9-11 Oct. 1979; sponsored by IEEE
(NASA-TM-79217; E-107) Avail: NTIS HC A02/MF A01 CSCL 17B

A program plan is presented for a space communications application utilizing the 30/20 GHz frequency bands (30 GHz uplink and 20 GHz downlink). Results of market demand studies and spacecraft systems studies which significantly affect the supporting research and technology program are also presented, along with the scheduled activities of the program plan. Author

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N79-28221*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
CYCLIC TESTS OF P-BULB END-SEAL DESIGNS FOR A SHUTTLE-TYPE WING-ELEVON COVE MEMBRANE SEAL
L. Roane Hunt Jul. 1979 30 p refs
(NASA-TM-80093; L-12958) Avail: NTIS HC A03/MF A01 CSCL 22B

Four P-bulb end seal designs were tested at room temperature in a cyclic seal test apparatus. Test results show that all the P-bulb end seals have the durability required for a 100 mission life (neglecting possible elevated-temperature effects) and three of the four P-bulbs provide an adequate seal against a 7.0-kPa air pressure differential. Antifriction material attached to the P-bulb rub surface reduced friction slightly but could degrade the sealing effectiveness. A flat rub surface molded into the P-bulb discouraged wrinkling and rolling and thereby reduced leakage. However, the P-bulbs lacked resilience, as indicated by increased leakage when P-bulb compression was reduced. The best P-bulb design tested included an antifriction interface bonded to a flat surface molded into the P-bulb. Author

N79-28222*# Martin Marietta Aerospace, Denver, Colo.
ON-BOARD ATTITUDE DETERMINATION SYSTEM (OADS) Final Study Report
P. Carney, M. Milillo, V. Tate, J. Wilson, and K. Yong Apr. 1978 277 p
(Contract NAS5-23428)
(NASA-CR-158842; MCR-78-514) Avail: NTIS HC A13/MF A01 CSCL 22B

The requirements, capabilities and system design for an on-board attitude determination system (OADS) to be flown on advanced spacecraft missions were determined. Based upon the OADS requirements and system performance evaluation, a preliminary on-board attitude determination system is proposed. The proposed OADS system consists of one NASA Standard IRU (DRIRU-2) as the primary attitude determination sensor, two improved NASA Standard star tracker (SST) for periodic update of attitude information, a GPS receiver to provide on-board space vehicle position and velocity vector information, and a multiple microcomputer system for data processing and attitude determination functions. The functional block diagram of the proposed OADS system is shown. The computational requirements are evaluated based upon this proposed OADS system. A.R.H.

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N79-28223*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APPLICATION OF THE MINIMUM CORRELATION TECHNIQUE TO THE CORRECTION OF THE MAGNETIC FIELD MEASURED BY MAGNETOMETERS ON SPACECRAFT
F. Mariani Apr. 1979 22 p refs Submitted for publication
(NASA-TM-80289) Avail: NTIS HC A02/MF A01 CSCL 14B

Some aspects of the problem of obtaining precise, absolute determination of the vector of low magnetic fields existing in the interplanetary medium are addressed. In the case of a real S/C, there is always the possibility of a spurious field which includes the spacecraft residual field and/or possible field from the sensors, due to both electronic drifts or changes of the magnetic properties of the sensor core. These latter effects may occur during storage of the sensors prior to launching and/or in-flight. The reliability is demonstrated for a method which postulates that there should be no correlation between changes in measured field magnitude and changes in the measured inclination of the field with respect to any one of three fixed Cartesian component directions. Application of this minimum correlation technique to data from IMP-8 and Helios 1-2 shows it is appropriate for determination of the zero offset corrections of triaxial magnetometers. In general, a number of the order of 1000 consecutive data points is sufficient for a good determination. A.R.H.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N79-28224*# Aerojet Liquid Rocket Co., Sacramento, Calif.
UNCONVENTIONAL NOZZLE TRADEOFF STUDY
C. J. OBrien Jul. 1979 311 p refs
(Contract NAS3-20109)
(NASA-CR-159520) Avail: NTIS HC A14/MF A01 CSCL 21H

Plug cluster engine design, performance, weight, envelope, operational characteristics, development cost, and payload capability, were evaluated and comparisons were made with other space tug engine candidates using oxygen/hydrogen propellants. Parametric performance data were generated for existing developed or high technology thrust chambers clustered around a plug nozzle of very large diameter. The uncertainties in the performance prediction of plug cluster engines with large

gaps between the modules (thrust chambers) were evaluated. The major uncertainty involves, the aerodynamics of the flow from discrete nozzles, and the lack of this flow to achieve the pressure ratio corresponding to the defined area ratio for a plug cluster. This uncertainty was reduced through a cluster design that consists of a plug contour that is formed from the cluster of high area ratio bell nozzles that have been scarfed. Light-weight, high area ratio, bell nozzles were achieved through the use of AGCarb (carbon-carbon cloth) nozzle extensions. Author

N79-28226*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HANDBOOK OF RECOMMENDED PRACTICES FOR THE DETERMINATION OF LIQUID MONOPROPELLANT ROCKET ENGINE PERFORMANCE
R. A. Bjorklund, R. S. Rogero, and R. K. Raerwald Jun. 1979 265 p refs Sponsored in part by AFRPL
(Contract NAS7-100)
(NASA-CR-158793; JPL-79-32; AFRPL-TR-79-24) Avail: NTIS HC A12/MF A01 CSCL 21H

This handbook is intended to serve as a guide for the experienced test engineer in the design, installation, and operation of systems to be used for the direct measurement of those quantities which are of fundamental importance to the determinations of monopropellant thruster performance. The procedures and defining relations for reducing the measurements to performance parameters are also given. Six discrete sections pertain to force and impulse measurement, propellant mass usage anf flow measurement, pressure measurement, temperature measurement, exhaust gas composition measurement, and data reduction and performance determination. References, appendixes, and glossaries are included with each section as necessary. A.R.H.

N79-28226*# Colorado State Univ., Fort Collins.
A SIMPLIFIED COMPUTER PROGRAM FOR THE PREDICTION OF THE LINEAR STABILITY BEHAVIOR OF LIQUID PROPELLANT COMBUSTORS
C. E. Mitchell and K. Eckert Aug. 1979 59 p refs
(Grant NGR-06-002-095)
(NASA-CR-3169) Avail: NTIS HC A04/MF A01 CSCL 21H

A program for predicting the linear stability of liquid propellant rocket engines is presented. The underlying model assumptions and analytical steps necessary for understanding the program and its input and output are also given. The rocket engine is modeled as a right circular cylinder with an injector with a concentrated combustion zone, a nozzle, finite mean flow, and an acoustic admittance, or the sensitive time lag theory. The resulting partial differential equations are combined into two governing integral equations by the use of the Green's function method. These equations are solved using a successive approximation technique for the small amplitude (linear) case. The computational method used as well as the various user options available are discussed. Finally, a flow diagram, sample input and output for a typical application and a complete program listing for program MODULE are presented. A.R.H.

N79-28227# ARO, Inc., Arnold Air Force Station, Tenn.
EXPERIMENTAL STUDY OF THE PLUME CHARACTERISTICS OF AN AGED MONOPROPELLANT HYDRAZINE THRUSTER Final Report, 13 Aug. 1976 - 5 Apr. 1977
W. D. Williams, T. D. McCay, H. M. Powell, and D. P. Weaver AEDC Apr. 1979 247 p refs
(AD-A068326; AEDC-TR-79-2) Avail: NTIS HC A11/MF A01 CSCL 21/8

An experimental study of the exhaust plume of an aged (200,000 pulses), 0.44 N (0.1 lbf), hydrazine monopropellant thruster was performed with the goal of characterizing both the gas dynamic and contamination properties of the vacuum plume expansion. The thruster was operated in a high vacuum chamber over a thrust range from 0.44 to 1.10 N (0.1 to .25 lbf) with a nominal 0.14-sec-on/9.86-sec-off duty cycle using initial catalyst bed (Shell 405) temperatures of 367 K (200F), 478 K (400F), and 589 K (699F). Exhaust plume diagnostic systems employed included a mass spectrometer probe, a quartz crystal microbalance (QCM), a laser-Raman/Rayleigh scattering system, an electron beam fluorescence system, and a particle collection network. These systems determined plume species number densities and temperature, mass deposition rates, and the level of particulates in the plume; they also permitted visualization of the plume. Traditional engine performance parameters were also determined in order to relate performance and exhaust plume properties. GRA

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N79-28228# Naval Surface Weapons Center, White Oak, Md.
MAGNETIZATION AND MAGNETIC ANISOTROPY OF TbFe2, DyFe2, Tb0.27Dy0.73Fe2 AND TmFe2
A. E. Clark, R. Abbundi, and W. R. Gillmor 9 Jan. 1979 12 p refs
(RR0220601)
(AD-A068615; NSWC/WOL/TR-79-17) Avail: NTIS HC A02/MF A01 CSCL 20/3

Saturation magnetizations were measured on single crystals of TbFe2, DyFe2, Tb0.27Dy0.73Fe2 and TmFe2. Over most of the temperature range from 4 K to 300 K, these values are substantially larger than those measured earlier on polycrystals. The intrinsic magnetic anisotropies, K1 (0)'s, as determined from magnetic fields required for saturation, are huge. For these highly magnetostrictive compounds, the magnetoelastic contribution to the anisotropy is a significant fraction of the total anisotropy. GRA

N79-28229# California Univ., Livermore. Lawrence Livermore Lab.
ON-LINE TESTS OF ORGANIC ADDITIVES FOR THE INHIBITION OF THE PRECIPITATION OF SILICA FROM HYPERSALINE GEOTHERMAL BRINE
J. E. Harrar, F. E. Locke, L. E. Lorensen, C. H. Otto, Jr., S. B. Deutscher, W. P. Frey, and R. Lim 3 Apr. 1979 27 p refs
(Contract W-7405-eng-48)
(UCID-18091) Avail: NTIS HC A03/MF A01

A number of compounds were screened as potential scale control agents by examining their effect on the precipitation of silica from Magmamax No. 1 brine. Solutions of the test substances were injected into flowing brine at approximately 200 C, the brine was flashed at 125 C, and then the kinetics of solids and silica precipitation from effluent brine held at 90 C were measured. Compounds tested include a variety of cellulose derivatives, ethylene oxide polymers, several polyethoxylated surfactants, and a phosphonate. The ethylene oxide moiety was confirmed as the source of activity in substances that inhibit the precipitation of silica at 90 C, and the polyethylene glycols in the molecular weight range of approximately 10,000 to 100,000 are the most effective. A brief, in-plant scaling test with the most promising precipitation inhibitor showed that, although it significantly retarded scaling at 90 C, there was no improvement at 125 C or higher, and at 125 C there may have been a slight increase in scaling rate. DOE

24 COMPOSITE MATERIALS

Includes laminates.

N79-28230 Illinois Univ. at Urbana-Champaign.
AN INVESTIGATION OF STRESS, TEMPERATURE, AND TIME DEPENDENT STRAINS IN A RANDOMLY ORIENTED FIBER REINFORCED COMPOSITE WITH SPECIAL EMPHASIS GIVEN TO THERMAL STRESS SITUATIONS Ph.D. Thesis
Edward Michael Caulfield 1979 94 p
Avail: Univ. Microfilms Order No. 7915328

The mechanical behavior of a glass fiber reinforced composite subjected to temperature change was studied. Primary emphasis is given to the topics of thermal stress, thermal expansion and contraction under an applied constant stress, and the phenomenon of Young's modulus being a function of temperature. Operationally simple constitutive equations and a viscoelastic model are

developed for this material and experimentally verified. Elastic and viscoelastic solutions for the problem of thermal stress as well as thermal expansion and contraction under an applied constant stress are compared and contrasted. Dissert. Abstr.

N79-28231 Connecticut Univ., Storrs.
CHARACTERIZATION OF THE EFFECTIVENESS OF SURFACE TREATMENTS FOR GLASS FIBERS IN COMPOSITES Ph.D. Thesis
Bunyamin Elbirli 1978 179 p
Avail: Univ. Microfilms Order No. 7913010

Two parameters were generated from the experimental aspect ratio data which characterize the effectiveness of surface treatments, namely: the interfacial shear strength, tau, which is a measure of the adhesion promoting capability of the coupling agent and the average distance between severe flaws, lambda, which is a measure of the fiber protection provided by a treatment formulation (sizing agent effectiveness). The embedded single filament technique and the associated theoretical analysis provide detailed insight into the micromechanical effects of surface treatments. This is of particular importance in the optimization of commercial fiber treatment formulations to obtain a trade-off between strength and toughness. Dissert. Abstr.

N79-28232* Boeing Commercial Airplane Co., Seattle, Wash.
ENVIRONMENTAL EXPOSURE EFFECTS ON COMPOSITE MATERIALS FOR COMMERCIAL AIRCRAFT
Daniel J. Hoffman Aug. 1978 49 p refs
(Contract NAS1-15148)
(NASA-CR-158838; D6-44815-3; QPR-3) Avail: NTIS HC A03 CSCL 11D

Activities reported include completion of the program design tasks, resolution of a high fiber volume problem and resumption of specimen fabrication, fixture fabrication, and progress on the analysis methodology and definition of the typical aircraft environment. Program design activities including test specimens, specimen holding fixtures, flap-track fairing tailcones, and ground exposure racks were completed. The problem experienced in obtaining acceptable fiber volume fraction results on two of the selected graphite epoxy material systems was resolved with an alteration to the bagging procedure called out in BAC 5562. The revised bagging procedure, involving lower numbers of bleeder plies, produces acceptable results. All required laminates for the contract have now been laid up and cured. Progress in the area of analysis methodology has been centered about definition of the environment that a commercial transport aircraft undergoes. The selected methodology is analagous to fatigue life assessment. A.R.H.

N79-28233*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Applied Mechanics Div.
A REVIEW OF COMPOSITE MATERIAL APPLICATIONS IN THE AUTOMOTIVE INDUSTRY FOR THE ELECTRIC AND HYBRID VEHICLE Annual Report, Nov. 1978
J. L. Bauer 15 Jul. 1979 80 p refs Prepared for DOE
(Contract NAS7-100)
(NASA-CR-158819; JPL-Pub-79-51) Avail: NTIS HC A05/MF A01 CSCL 11D

A review is made of the state-of-the-art in regard to the use of composite materials for reducing the structural mass of automobiles. Reduction of mass provides, in addition to other engineering improvements, increased performance/range advantages that are particularly needed in the electric and hybrid vehicle field. Problems encountered include the attainment of mass production techniques and the prevention of environmental hazards. Author

N79-28234*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMAL-CONDUCTIVITY MEASUREMENTS OF TUNGSTEN-FIBER-REINFORCED SUPERALLOY COMPOSITES USING A THERMAL-CONDUCTIVITY COMPARATOR
Leonard J. Westfall and Edward A. Winsa Jul. 1979 23 p refs
(NASA-TP-1445; E-9910) Avail: NTIS HC A02/MF A01 CSCL 11D

The thermal conductivity (TC) of tungsten-fiber-reinforced superalloys was determined for two composite systems by using a thermal conductivity standard from the National Bureau of Standards and a comparator and technique developed for that purpose. The results were compared with TC data for the nickel-base alloy MAR-M200. The technique lends itself to applications involving thin specimens, such as thin-walled turbine blades. The TC's of the composite systems were considerably higher in both the longitudinal and transverse directions than that of the monolithic superalloys used as the matrices. Author

N79-28235*# Rensselaer Polytechnic Inst., Troy, N. Y.
COMPOSITE STRUCTURAL MATERIALS Semiannual Progress Report, Oct. 1978 - Apr. 1979
George S. Ansell, Robert G. Loewy, and Stephen E. Wiberly Jul. 1979 130 p Sponsored jointly by NASA and AFOSR
(Grant NGL-33-018-003)
(NASA-CR-158851; SAPR-36) Avail: NTIS HC A07/MF A01 CSCL 11D

Technology utilization of fiber reinforced composite materials is discussed in the areas of physical properties, and life prediction. Programs related to the Composite Aircraft Program are described in detail. R.E.S.

N79-28236# State Univ. of New York at Buffalo. Dept. of Engineering Science,Aerospace Engineering and Nuclear Engineering.
LIE-THEORY FOR A ONE-DIMENSIONAL LAMINATED COMPOSITE AND THE PROBLEM OF HOMOGENIZATION Final Report
G. A. Becus (Cincinnati Univ.), P. A. Dashner (Cornell Univ., Ithaca, N. Y.), and R. K. Kaul Dec. 1978 38 p refs
(Contract N00014-75-C-0302)
(AD-A067428; Rept-102) Avail: NTIS HC A03/MF A01 CSCL 11/4

The paper deals with the development of a continuum theory for time-harmonic longitudinal waves propagating in a one-dimensional laminated composite with periodic structure. The development is based on the method of Lie-series and a hierarchy of improved approximate theories are obtained for wavelengths longer than the typical dimensions of the composite microstructure. Effective material properties are also defined and the dispersion spectrum compared with the exact theory, over one Brillouin zone. It is also shown how the effective properties of the laminated, periodic composite can also be obtained by homogenization via a multiple scale expansion. Author (GRA)

N79-28237# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
SR-52 MAGNETIC CARD CALCULATOR SOLUTIONS TO COMPOSITE MATERIALS WORKBOOK Interim Report, 1 Jan. 1977 - 1 Mar. 1978
Stephen W. Tsai, H. Thomas Hahn, and Frank Huber Jan. 1979 186 p
(AF Proj. 2419)
(AD-A067987; AFML-TR-77-50) Avail: NTIS HC A09/MF A01 CSCL 09/2

This is a companion volume to AFML-TR-78-33, 'Composite Materials Workbook'. Both workbook and its solutions are intended to present to the users of composite materials a set of tools to solve most commonly encountered problems in design and testing. Attempts are made to simplify both the operational and conceptual aspects. Subjects are selected from the standpoint of practical application rather than elegance. Programmable pocket calculators, preferably with magnetic card capability, are found to be most suitable to perform the calculations in the workbook. In this report, the description, operating instructions, program listing, and sample problems for these calculations have been compiled for Texas Instruments SR-52. It is believed that composite materials are simple in concept and easy to describe quantitatively with the aid of card programmable calculators. The performance characteristics of composite materials can now be fully appreciated and utilized. Author (GRA)

N79-28238# McDonnell Aircraft Co., St. Louis, Mo.
BOLTED FIELD REPAIR OF COMPOSITE STRUCTURES Final Report, 27 Sep. 1977 - 30 Sep. 1978
James B. Watson, D. A. Glaeser, F. L. Harvey, W. T. Fukimoto, and V. E. Padilla 1 Mar. 1979 212 p refs
(Contract N62269-77-C-0366)

(AD-A067923; MDC-A5583; NADC-77109-30) Avail: NTIS HC A10/MF A01 CSCL 11/2

Mechanically fastened, field repairs for graphite/epoxy laminates 3/16 and 1/2 inch thick with through-the-thickness hole damage have been successfully demonstrated. These repairs (titanium alloy patches and backing plates) were developed for application on fuel cell composite wing surfaces and can be installed by maintenance personnel in the field using available equipment, materials, and methods. A total of 28 specimens were fabricated and tested statically to evaluate effectiveness of selected repair designs. GRA

N79-28239# Drexel Univ., Philadelphia, Pa. Dept. of Materials Engineering.

MICROSTRUCTURAL STABILITY AND STRENGTH OF THE Co, Cr-(Cr,Co)7C3 IN-SITU COMPOSITE Final Report

H. Saatchi and A. Lawley Mar. 1979 44 p refs

(Contract N00014-76-C-0205)

(AD-A067899) Avail: NTIS HC A03/MF A01 CSCL 11/4

The effect of elevated temperature isothermal exposure and thermal cycling on microstructural stability and compressive strength of the in situ rod-like composite Co,Cr(Cr,Co)7 C3 (Vf approx. 0.3) has been examined. Microstructures were characterized by optical and electron metallography, x-ray point analysis and electron diffraction. Strength was evaluated in compression at ambient and elevated temperatures. Changes in microstructure with post-solidification treatments are shown to arise from a combination of precipitation and dissolution of (Co,Cr)23 C6, rounding and splitting of the primary (Co,Cr)7 C3 fibers, spheroidization of constituents and void formation at fiber-matrix interfaces. The observed strength changes are analyzed in terms of a dispersion-hardening model. Failure in compression below the ductile to brittle transition temperature of the reinforcement occurs by shear in the matrix accompanied by transverse cleavage of the fibers. Above the ductile-to-brittle transition temperature of the reinforcing phase both matrix and carbide exhibit plastic flow. Author (GRA)

N79-28240# Syracuse Univ., N. Y. Dept. of Electrical and Computer Engineering.

THIN-WIRE METHODS FOR ELECTROMAGNETIC PROBLEMS INVOLVING ADVANCED COMPOSITE MATERIALS Phase Report, Oct. 1977 - Sep. 1978

A. T. Adams and C. Chang Griffiss AFB, N. Y. RADC Feb. 1979 58 p refs

(Contracts F30602-78-C-0083; F30602-75-C-0121; AF Proj. 2338)

(AD-A068179; RADC-TR-79-18) Avail: NTIS HC A04/MF A01 CSCL 11/4

This report describes loaded thin-wire models for the representation of the electromagnetic properties of advanced composite materials. Techniques are described for the treatment of thin-wire antennas over advanced composite surfaces and for back-scattering from composites. Special techniques are required for the representation of attachment points. Skin effect is taken into account. Antenna efficiency and gain are computed. The results indicate that a small metal 'pad' at attachment points may significantly improve efficiency. Far field beam patterns may remain essentially unchanged as efficiency or backscatter varies over a wide range. GRA

N79-28241# Aerospace Corp., El Segundo, Calif. Vehicle Engineering Div.

THE NONEQUILIBRIUM ABLATION OF CARBON Final Report, Sep. 1977 - Jun. 1978

P. G. Crowell 15 Nov. 1978 86 p refs

(Contracts F04701-78-C-0079; F04701-78-C-0078)

(AD-A068198; TR-0079(4550-76)-1; SAMSO-TR-79-6) Avail: NTIS HC A05/MF A01 CSCL 21/2

A comprehensive analysis is presented of the nonequilibrium ablation of carbon in an atmosphere whose elemental composition consists of Oxygen, Nitrogen, Carbon and an inert species. The scope of the investigation ranges from the low surface temperature regime, where the ablation process is dominated by kinetically controlled oxidation reactions, to the high temperature sublimation regime dominated by rate-controlled vaporization. A detailed examination is made of the commonly employed assumption concerning the gas-phase and gas-solid reaction rates. In particular, calculations are presented for the limiting assumptions of fast (equilibrium) and slow (frozen) homogeneous and heterogeneous reactions. The vaporization from a liquid carbon melt layer is analyzed and calculations are presented for the surface mass loss and melt layer thickness. Comparisons are made with the available experimental data and recommendations made for future experimental investigation. GRA

N79-28242# Battelle Columbus Labs., Ohio.

EXPLORATORY RESEARCH ON SILICON RIBBON CASTING Final Technical Report, 2 Aug. 1977 - 1 Sep. 1978

R. E. Maringer Nov. 1978 32 p refs

(Contract F33615-74-C-5179; AF Proj. 7357)

(AD-A068126; AFML-TR-78-151) Avail: NTIS HC A03/MF A01 CSCL 11/2

Experiments have shown that it is possible to cast, by pendant drop melt extraction, short lengths of silicon ribbon in widths up to 4-5 mm and thicknesses up to 0.4 - 0.5 mm, at speeds of 3-4 cm/s. The metallographic structure and the mechanical integrity of the ribbon suggests that a wide product with controlled dimensions and grain size could be cast continuously using crucible melt extraction with an adequate melt supply and a modified extractor system. GRA

N79-28243# Lehigh Univ., Bethlehem, Pa. Inst. of Fracture and Solid Mechanics.

AN EMBEDDED CRACK IN A LAMINATE WITH ADHESIVE LAYERS Final Report

E. P. Chen and G. C. Sih Aug. 1977 79 p refs

(Contract N62269-76-C-0075)

(AD-A069063; IFSM-77-80) Avail: NTIS HC A05/MF A01 CSCL 20/11

The five-layered composite as treated in this work consists of three plates bonded together with adhesives. The thickness of the adhesives, though small, is included in the analysis resulting in the five layer geometry. A dominant flaw is assumed to prevail at the center of the middle layer when the composite is being stretched uniformly and to overshadow the other types of mechanical damages such as matrix/fiber debonding, fiber breaking, etc. In order to gain a knowledge of the failure mode of the layered composite, the load transmission characteristics which depend upon the geometrical and material constants must be known through a stress analysis. This is accomplished by appealing to an approximate theory of laminates developed from variational principles. The character of the solution is three-dimensional and is sufficiently accurate for predicting physically realizable failure modes. The stress distribution obtained may be further applied in conjunction with a failure criterion to determine whether delamination will occur prior to unstable crack propagation or not. The pertinent parameter, stress intensity factor, is obtained for a variety of material and geometrical constants. GRA

N79-28244# Fiber Materials, Inc., Biddeford, Maine.

ADVANCED IMPACT RESISTANT MULTIDIMENSIONAL COMPOSITES Final Report, Oct. 1977 - Nov. 1978

John W. Herrick 30 Jan. 1979 128 p refs

(Contract N00019-77-C-0430)

(AD-A068517; FR-79-1-3) Avail: NTIS HC A07/MF A01 CSCL 11/4

Conventional pseudo-isotropic advanced composites may be excessively damaged under certain kinds of low mass and velocity impact conditions on naval aircraft. Therefore, a materials development program has been conducted to evaluate the potential of multidimensional graphite fiber reinforced composites for improved impact resistance. Several multidimensional graphite fiber-epoxy composites were fabricated and tested as flexure beams and plates. Both types of tests showed that the multidimensional composites possessed increased impact strength compared to two-dimensional (2D) composites. The data indicated that the construction of the multidimensional composite must be designed for the particular type of impact encountered in order to maximize impact resistance. Post impact examination of the test specimens indicated that the multidimensional composites absorbed energy by different mechanisms than 2D composites. The 2D composites delaminated extensively, while the composite fracture was restricted to a relatively small area in the 3D materials. Therefore, multidimensional composites

absorb more energy over a smaller area than 2D laminates. GRA

N79-28245# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
INFLUENCE OF JET FUEL ON PERMEATION AND FLAMMABILITY CHARACTERISTICS OF GRAPHITE EPOXY COMPOSITES
Lourdes C. Fuller, David A. Lutz, and Edward R. Wright 21 Feb. 1979 26 p
(WF41400000)
(AD-A068586; NADC-79022-60) Avail: NTIS HC A03/MF A01 CSCL 11/4

Graphite epoxy composites were subjected to controlled studies of fuel permeation, fuel immersion and flammability in an effort to judge their safety and effectiveness as a material for use in jet fuel tanks. GRA

N79-28246# Northwestern Univ., Evanston, Ill.
THERMALLY STIMULATED DISCHARGE CURRENT ANALYSIS OF EPOXY RESINS Annual Technical Report, 1 Feb. 1978 - 31 Jan. 1979
W.-F. A. Su, T.-D. Chang, S. H. Carr, and J. O. Brittain 10 Apr. 1979 40 p refs
(Contract N00014-78-C-0276)
(AD-A069123; ATR-1) Avail: NTIS HC A03/MF A01 CSCL 11/9

The epoxy resin system, tetraglycidyl-4,4:-diaminodiphenylmethane (TGDDM) cured with 4,4:-diaminodiphenylsulfone (DDS) has been studied. Primary emphasis has been placed on characterizing molecular relaxation processes as can be detected by Thermally Stimulated Discharge Current (TSDC) analysis. Ancillary characterization methods, including calorimetry, spectroscopy, and mechanical properties, have also been employed. It is seen that TSDC clearly reveals differences which can systematically be related to: composition (formulation), cure time, and cure temperature. At least 4 individual contributions to the molecular relaxation processes occurring in the temperature range 100-250 K have been identified, but not all such contributions are sensitive to the make-up of the resin itself. Research presented in this report gives evidence to the capabilities of our research seeking to make progress into a deeper understanding of such epoxy resin systems. GRA

N79-28247# California Univ., Livermore. Lawrence Livermore Lab.
ARAMID FIBER COMPOSITES
T. T. Chiao 19 Dec. 1978 12 p Presented at the Intern. Conf. on Fracture Mech. in Eng. Appl., Bangalore, India, 26-30 Mar. 1979
(Contract W-7405-eng-48)
(UCRL-81501; Conf-790307-1) Avail: NTIS HC A02/MF A01

Aramid fiber potential as a reinforcement for fiber composites is summarized. Available data on the fiber structure, method of manufacturing, tensile properties of the fiber in the presence of the epoxy matrix, and unidirectional composite properties are reviewed. Typical applications of aramid fiber composites were examined. DOE

N79-28248# Oak Ridge National Lab., Tenn. Solid State Div.
LASER ANNEALING OF ION IMPLANTED SILICON
C. W. White, J. Narayan, and R. T. Young Nov. 1978 17 p refs Presented at AIP Conf. on Laser-Solid Interactions and Laser Process., Boston, 28 Nov. - 1 Dec. 1978
(Contract W-7405-eng-26)
(CONF-781167-2) Avail: NTIS HC A02/MF A01

The physical and electrical properties of ion implanted silicon annealed with high powered ruby laser radiation are summarized. Results show that pulsed laser annealing can lead to a complete removal of extended defects in the implanted region accompanied by incorporation of dopants into lattice sites even when their concentration far exceeds the solid solubility limit. DOE

N79-28249# Sandia Labs., Albuquerque, N. Mex.
EFFECT OF MOISTURE ON THE STRENGTH OF KEVLAR 29 RIBBON PARACHUTE FABRICS
R. H. Eriksen and L. Orear 1979 6 p refs Presented at 6th AIAA Aerodyn. Deceleration and Balloon Technol. Conf., Houston, Tex., 5 Mar. 1979
(Contract EY-76-C-04-0789)
(SAND-78-1922; Conf-790308-2) Avail: NTIS HC A02/MF A01

The effect of moisture on the strength of Kevlar 29 ribbon parachute fabrics was investigated. Individual yarn samples and various fabrics were soaked in water for periods of 1 to 30 minutes. Yarn strength did not change; however, fabric strength was reduced. The reductions ranged from 3 to 13 percent depending upon the fabric construction. Additional experiments eliminated factors such as the weaving process, yarn swelling, and increased abrasion in the presence of moisture as possible mechanisms. Other tests demonstrated that increased interyarn friction occurs when moisture is present. These results suggest that the moisture-enhanced friction restrains highly loaded filaments from adjusting their position and relieving stress concentrations. Specific construction parameters governing the amount of strength reduction were not defined in this study. However, it is evident that moisture effects should be considered in parachute material selection and design. DOE

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N79-28250 Alfred Univ., N.Y.
THE VIBRATIONAL SPECTROSCOPY OF SOME CALCIUM PHOSPHATES Ph.D. Thesis
Frank Samuel Casciani 1978 223 p
Avail: Univ. Microfilms Order No. 7914144

Analysis of the vibrational data presented indicated that the site group model is inadequate and at least a factor group model is required. The two site effect was observable for the orthophosphate ions, the acid phosphate ions and the water molecules in all cases in which the structure so predicted. In octacalcium phosphate, both the infrared and Raman spectra were poorly resolved due to the overlap of the predicted 165 Raman and 162 infrared active bands. Dissert. Abstr.

N79-28251 Purdue Univ., Lafayette, Ind.
BIOANALYTICAL APPLICATIONS OF LIQUID CHROMATOGRAPHY WITH AMPEROMETRIC DETECTION Ph.D. Thesis
Lawrence A. Pachla 1978 196 p
Avail: Univ. Microfilms Order No. 7914948

A number of assays for biologically important molecules was developed utilizing liquid chromatography with electrochemical detection (LCEC). The application of LCEC to the quantitation of ascorbic and uric acids has resulted in methodology that is highly sensitive and specific. Each of these compounds can be detected at the picogram level. Research was conducted in the area of post column mixing for the improvement of the electrochemical detection process. Evaluation and optimization of this unique approach are presented. Application of LCEC to the determination of ascorbic acid in multivitamin preparations, fruits, juices, milk products, urine, and serum was evaluated. The overall precision of the method was found to be 2% relative standard deviation and a sample precessing rate of 12-20/hour was practical. Dissert. Abstr.

N79-28252 California Univ., Berkeley.
SOLVENT SELECTIVITY FOR PURIFICATION OF NATURAL CASES Ph.D. Thesis
Orlando Rafael Rivas 1978 122 p
Avail: Univ. Microfilms Order No. 7914742

A gas solubility apparatus was developed for measuring the solubility of gases in pure or mixed solvents at pressures below one atmosphere and at temperatures ranging from -20 to 200 C.

Equilibrium solubilities accurate to about one percent are determined from total gas pressure and from material balances. This apparatus was used for research on purification of sour natural gases by absorption. The absorbing liquid was a mixture, containing one chemical solvent and one physical solvent. Preliminary design calculations for sweetening natural gases by absorption suggest that under some circumstances, mixed solvent absorption may be economically superior to absorption using conventional aqueous alkanolamine solutions. Dissert. Abstr.

N79-28253* National Aeronautics and Space Administration. Pasadena Office, Calif.
CHEMICAL VAPOR DEPOSITION REACTOR Patent
Shy-Shiun Chern (JPL) and Joseph Maserjian, inventors (to NASA) (JPL) Issued 5 Jul. 1977 6 p Filed 12 Jul. 1976 Sponsored by NASA
(NASA-Case-NPO-13650-1; US-Patent-4,033,286; US-Patent-Appl-SN-704468; US-Patent-Class-118-49; US-Patent-Class-23-252R; US-Patent-Class-427-95; US-Patent-Class-248; US-Patent-Class-253; US-Patent-Class-423-33-5; US-Patent-Class-337; US-Patent-Class-349) Avail: US Patent and Trademark Office CSCL 07D

An improved chemical vapor deposition reactor is characterized by a vapor deposition chamber configured to substantially eliminate non-uniformities in films deposited on substrates by control of gas flow and removing gas phase reaction materials from the chamber. Uniformity in the thickness of films is produced by having reactive gases injected through multiple jets which are placed at uniformally distributed locations. Gas phase reaction materials are removed through an exhaust chimney which is positioned above the centrally located, heated pad or platform on which substrates are placed. A baffle is situated above the heated platform below the mouth of the chimney to prevent downdraft dispersion and scattering of gas phase reactant materials.

Official Gazette of the U.S. Patent and Trademark Office

N79-28254 Pennsylvania State Univ., University Park.
EROSIVE BURNING STUDY OF COMPOSITE SOLID PROPELLANTS BY THE REACTING TURBULENT BOUNDARY-LAYER APPROACH Ph.D. Thesis
Mohan Kishen Razdan 1979 198 p
Avail: Univ. Microfilms Order 7915732

The propellant burning process was described theoretically by considering a steady, two-dimensional, chemically reacting, turbulent boundary layer over a propellant surface. The diffusion-controlled gas-phase chemical reaction was modeled on the basis of the eddy-break-up concept. The theoretical model, comprised of a set of partial differential equations, was solved numerically. Experimentally, a flat composite-propellant slab was burned in a test chamber by the flow of hot combustion gases which formed a turbulent boundary layer over the surface of the propellant. The burning rate of the propellant was measured by a high-speed motion picture technique at various pressures and free-stream velocities. Results indicate that the erosive burning effect is caused by the increase in gas-to-solid heat feedback introduced by the increase in transport coefficients, and the turbulence-enhanced mixing and reaction of the oxidizer and fuel gases.

Dissert. Abstr.

N79-28255 British Library Lending Div., Boston Spa (England).
A SIMPLE EFFLUENT STREAM-SPLITTING DEVICE FOR HIGH RESOLUTION GLASS CAPILLARY COLUMNS
F. Etzweiler and N. Neuner-Jehle May 1979 14 p refs Transl. into ENGLISH from Chromatographia (West Ger.), v. 6, no. 12, 1973 p 503-507
(BLL-RTS-11735) Avail: British Library Lending Div., Boston Spa, Engl.

Glass and platinum capillaries are used in an effluent stream splitting device. The system is equipped with a feed line for additional gas to allow the split ratio to be changed continuously over a wide range without loss of chromatographic resolution.

A.R.H.

N79-28256 British Library Lending Div., Boston Spa (England).
SURFACE TENSION OF TRANSFORMER OILS AND CERTAIN GROUPS OF HYDROCARBONS ISOLATED FROM THEM
R. Sh. Kuliev et al May 1979 7 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Neft Gaz (USSR), no. 3, 1978 p 49-51
(BLL-RTS-11877) Avail: British Library Lending Div., Boston Spa, Engl.

The influence of refining technology and hydrocarbon composition on the surface tension of transformer oils obtained from low sulphur, low paraffin oil was studied. Investigations of surface tension at an interface with air were effected in the temperature range 293-373 K by the method of maximum pressure of bubbles or drops. Temperature dependence of surface tension was also studied. Research showed that in a small temperature range, the surface tension of petroleum products decreased linearly with temperature rise. A similar relationship was found with density.

R.E.S.

N79-28257 British Library Lending Div., Boston Spa (England).
STUDY OF CONDITIONS OF AUTO-COMBUSTION OF RUBBERS AND CRUDE RUBBER MIXTURES
Zsolt Pap Jun. 1979 21 p Transl. into ENGLISH from Muanyag Gumi (Hungary), v. 7, no. 7, 1970 p 243-248
(BLL-RTS-11527) Avail: British Library Lending Div., Boston Spa, Engl.

The thermochemistry of rubbers and rubber mixtures was examined to determine the factors affecting the spontaneous combustion of these materials. It was concluded that if there is sufficient oxygen available for combustion, self ignition takes place. If not, the temperature of the system further increases without ignition and may reach the temperature of self ignition of solid components of the system.

M.M.M.

N79-28258*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE ROLE OF NaCl IN FLAME CHEMISTRY, IN THE DEPOSITION PROCESS, AND IN ITS REACTIONS WITH PROTECTIVE OXIDES AS RELATED TO HOT CORROSION
Fred J. Kohl and Carl A. Stearns 1979 27 p refs Prepared for 4th Conf. on Gas Turbine Materials in a Marine Environment, Annapolis, Md, 25-28 Jun. 1979
(NASA-TM-79225; E-120) Avail: NTIS HC A03/MF A01 CSCL 07D

Sodium chloride is believed to be the primary source of turbine engine contamination that contributes to hot corrosion. The behavior of NaCl-containing aerosols ingested with turbine intake air is very complex; some of the NaCl may vaporize during combustion while some may remain as particulates. The NaCl can lead to Na_2SO_4 formation by several possible routes or it can contribute to corrosion directly. Hydrogen or oxygen atom reaction with NaCl(c) was shown to result in the release of Na(g). Gaseous NaCl in flames can be partially converted to gaseous Na_2SO_4 by homogeneous reactions. The remaining gaseous NaCl and other Na-containing molecules can act as sodium carriers for condensate deposition of Na_2SO_4 on cool surfaces. A frozen boundary layer theory was developed to predict the rates of deposition. The condensed phase NaCl can be converted directly to condensed Na_2SO_4 by reaction with sulfur oxides and O_2. Reaction of gaseous NaCl with Cr_2O_3 results in the vapor phase transport of chromium by the formation of complex Cr-containing gaseous molecules. Similar gaseous complexes are formed with molybdenum. The presence of gaseous NaCl was shown to affect the oxidation kinetics of Ni-Cr alloys. It also causes changes in the surface morphology of Al_2O_3 scales formed on Al-containing alloys.

F.O.S.

N79-28259*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
CHEMICAL KINETIC MODELING OF BENZENE AND TOLUENE OXIDATION BEHIND SHOCK WAVES
Allen G. McLain, Casimir J. Jachimowski, and Charles H. Wilson Aug. 1979 26 p refs
(NASA-TP-1472; L-12803) Avail: NTIS HC A03/MF A01 CSCL 07D

The oxidation of stoichiometric mixtures of benzene and toluene behind incident shock waves was studied for a temperature range from 1700 to 2800 K and a pressure range from 1.1 to 1.7 atm. The concentration of CO and CO_2 produced were measured as well as the product of the oxygen atom and

carbon monoxide concentrations. Comparisons between the benzene experimental data and results calculated by use of a reaction mechanism published in the open literature were carried out. With some additional reactions and changes in rate constants to reflect the pressure-temperature range of the experimental data, a good agreement was achieved between computed and experimental results. A reaction mechanism was developed for toluene oxidation based on analogous rate steps from the benzene mechanism. Measurements of NOx levels in an actual flame device, a jet-stirred combustor, were reproduced successfully by use of the reaction mechanism developed from the shock-tube experiments on toluene. These experimental measurements of NOx levels were reproduced from a computer simulation of a jet-stirred combustor. Author

N79-28260# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
PHOTOCHEMISTRY AND ELECTRONIC STRUCTURE OF BIS (DICARBONYL (ETA-5-CYCLOPENTADIENYL) RUTHENIUM) AND ITS IRON ANALOGUE Interim Technical Report
Harmon B. Abrahamson, Michael C. Palazzotto, Carol L. Reichel, and Mark S. Wrighton 3 Apr. 1979 28 p refs
(Contract N00014-75-C-0880; NR Proj. 051-579)
(AD-A067596; TR-15) Avail: NTIS HC A03/MF A01 CSCL 07/2

The photochemistry of a number of dinuclear metal-metal bonded organometallic complexes is dominated by cleavage of the metal-metal bond. This chemistry is in accord with lowest excited states which involve the population of an orbital which is strongly antibonding (sigma) with respect to the metal-metal bond. All of the complexes for which detailed studies have been reported involve systems for which the metal-metal bond is not bridged. A number of qualitative observations have been described which strongly implicate symmetrical cleavage reactions of bridged systems subsequent to electronic excitation. GRA

N79-28261# New York Univ., N. Y. Dept. of Chemistry.
AN APPARATUS FOR THE MEASUREMENT OF PHOTOELECTRON EMISSION CURRENT WITH ON-LINE COMPUTER DATA ACQUISITION. PART 1: DESCRIPTION OF CELL AND OPERATIONAL PROCEDURES. PART 2: ELECTRONICS, COMPUTER INTERFACING AND PROGRAMMING
Iwao Watanabe and James B. Flanagan 30 Mar. 1979 41 p refs
(Contract N00014-75-C-0397)
(AD-A067589; TR-7) Avail: NTIS HC A03/MF A01 CSCL 07/4

Described is a new apparatus which enables us to obtain quantum yield data for liquids or solutions of up to about 5-torr vapor pressure, e.g., aqueous solutions, using photon energies up to 10.5 eV. Data are taken by on-line minicomputer and are stored on floppy disk for later analysis. Features of the apparatus include: efficient temperature control; continuous renewal of liquid surface; very short path of light through vapor to minimize photon absorption or gas phase electron emission; use of light chopping and bandpass filtering to enhance sensitivity. Author (GRA)

N79-28262# Colorado State Univ., Fort Collins. Dept. of Chemistry.
STUDIES IN ELECTROANALYTICAL CHEMISTRY AND RAMAN SPECTROSCOPY IN INORGANIC SOLVENTS Final Report, 1 Oct. 1976 - 30 Jun. 1979
R. A. Osteryoung Apr. 1979 16 p refs
(Contract N00014-77-C-0004)
(AD-A067883) Avail: NTIS HC A02/MF A01 CSCL 07/2

Work on electroanalytical chemistry, generally involving on-line computerized instrumentation, is summarized. Studies in chloroaluminate melts, predominantly involving n-butylpyridinium chloride-aluminum chloride, are summarized. Studies involving Raman spectroscopy, potentiometry, infrared spectroscopy and voltammetry are summarized. Author (GRA)

N79-28263# Arizona Univ., Tucson. Dept. of Chemistry.
CHARACTERISTICS OF A HIGH SOLIDS NEBULIZER FOR FLAME ATOMIC ABSORPTION SPECTROMETRY Interim Report
R. C. Fry and M. B. Denton Apr. 1979 40 p refs
(Contract N00014-75-C-0513)
(AD-A067866; TR-21) Avail: NTIS HC A03/MF A01 CSCL 07/4

Studies are presented to characterize a new nebulizer developed for direct atomic absorption analysis of extremely complex clinical and environmental materials. Important parameters are described concerning the design and performance of 'high solids' spectrochemical nebulizers based on the Babington principle. A new simplified design is presented and mechanisms of undesirable sample wastage are considered. Data are presented concerning the effect of impaction on conventional and 'high solids' aerosol generation. Author (GRA)

N79-28264# University of Southern California, Los Angeles. Dept. of Chemistry.
QUENCHING OF EMISSION AND OF PHOTOCHEMISTRY FOR AQUEOUS Rh(NH3)5Cl(2+)
Arthur W. Adamson, Robert Fukuda, Marina Larson, Helmut Macke, and Jean Pierre Puaux Apr. 1979 13 p refs
(Contract N00014-76-C-0548)
(AD-A067748; TR-8) Avail: NTIS HC A02/MF A01 CSCL 07/2

Aqueous Rh(NH3)5Cl2+ shows emission and excited state absorption, ESA, decaying with the same lifetime. The temperature dependence of emission and of ESA, attributed to the first triplet thexi state, corresponds to an apparent activation energy of 5.4 plus or minus 0.3 kcal/mole. The photochemistry, predominantly chloride aquation, is also quenched. In the case of OH-, results indicate that 85-90% of the photoreaction is quenched on complete emission quenching. GRA

N79-28265# Army Armament Research and Development Command, Aberdeen Proving Ground, Md. Ballistics Research Lab.
TRAJECTORY CALCULATIONS FOR THE REACTION OF O ATOMS WITH OH
Arthur Gauss, Jr. Mar. 1979 25 p refs
(AD-A069081; AD-E430229; ARBRL-TR-02149) Avail: NTIS HC A02/MF A01 CSCL 07/4

Trajectory calculations have been used to calculate cross sections and specific rate constants for the two channels of the O + OH, reaction. Channel 1 is the exchange reaction O + O:H yields O: + OH, channel 2 the reaction O + OH yields H + OH2. From the specific rates, estimates of the overall thermal rate constants are calculated. The minimum thermal rate constant calculated for the channel 2 reaction is (5.4 + or - 0.7) x 10 to the -11th power cc/molecule sec. at 300 K, a value within error limits of that recommended by Wilson. The temperature dependence of this thermal rate constant, although higher, follows the shape of the curve of Kurzius and Boudart. The exchange reaction (channel 1) is estimated to be one third to one fifth as probable as the channel 2 reaction. Author (GRA)

N79-28266# Norges Tekniske Hoegskole, Trondheim. Inst. for Uorganisk Kjemi.
VISCOSITY OF CHLOROALUMINATE MELTS Final Report, 1 Jan. 1977 - 31 Dec. 1978
Harald A. Oye and Knut Toerklep 28 Feb. 1979 68 p refs
(Grant AF-AFOSR-3198-77; AF Proj. 2303)
(AD-A069000; AFOSR-79-0597TR) Avail: NTIS HC A04/MF A01 CSCL 07/2

A precision oscillation viscometer for determination of the viscosity for low-viscous salts with high vapour pressures has been developed. The viscosity is determined from the damping of a hollow cylinder filled with the salt to be investigated. GRA

N79-28267# Stanford Univ., Calif. Dept. of Mechanical Engineering.
COMBUSTION GAS MEASUREMENTS USING TUNABLE LASER ABSORPTION SPECTROSCOPY Interim Report
R. K. Hanson 15 Jan. 1979 9 p refs Presented at the 17th Aerospace Sci. Meeting, New Orleans, 15-17 Jan. 1979
(Contract F49620-78-C-0026; AF Proj. 2308)
(AD-A068769; AFOSR-79-0625TR) Avail: NTIS HC A02/MF A01 CSCL 07/4

Applications of tunable infrared diode lasers for combustion gas measurements are described. The diode laser serves as a

source of narrow-linewidth infrared radiation whose wavelength can be rapidly modulated to perform fast, high-resolution absorption spectroscopy. Measurements of fully resolved vibration-rotation lines in the fundamental band of CO are used to infer temperature, CO species concentrations and CO collisions halfwidths in the post-flame gases of a flat flame burner. The feasibility of diode laser measurements in fluctuating and particle-laden combustion flows is also demonstrated. GRA

N79-28268# Stanford Univ., Calif. High Temperature Gasdynamics Lab.
DEVELOPMENT OF COMBUSTION DIAGNOSTICS AND APPLICATION TO TURBULENT COMBUSTION Interim Scientific Report, 16 Feb. 1978 - 15 Mar. 1979
R. K. Hanson and C. T. Bowman Apr. 1979 14 p refs
(Contract F49620-78-C-0026)
(AD-A068753; AFOSR-79-0522TR) Avail: NTIS HC A02/MF A01 CSCL 21/2

Experiments have been conducted in steady, fluctuating and sooting flames produced in flat flame and slot burners operating on premixed fuel and air at atmospheric pressure. Measurements of temperature, CO species concentration and CO spectroscopic parameters have been made using a tunable diode laser absorption technique. The measurements involve rapidly scanning the narrow-linewidth diode laser across individual vibration-rotation lines in the fundamental band of CO at 4.6 microns to record fully-resolved absorption line profiles in times as short as 100 microseconds. A conventional microprobe sampling system to monitor CO and CO2 concentrations has been constructed to enable comparisons between laser-based and conventional measurements; thermocouples have been used to allow comparisons with laser-based temperature measurements. Initial results in fuel-rich flames show good agreement. Work is in progress to modify the burner system to allow comparisons over a wider range of stoichiometries. GRA

N79-28269# California Univ., Berkeley. Lawrence Berkeley Lab.
EFFECT OF NITROGEN OXIDE PRETREATMENTS ON ENZYMATIC HYDROLYSIS OF CELLULOSE M.S. Thesis
R. K. Borrevik, C. R. Wilke, and D. L. Brink Sep. 1978 113 p refs
(Contract W-7405-eng-48)
(LBL-7879) Avail: NTIS HC A06/MF A01

The effect of nitrogen oxide pretreatments on the subsequent enzymatic hydrolysis by Trichoderma viride cellulase of the cellulose occurring in wheat straw; Triticum Aestivum-L. em. Thell is considered. The straw is first reacted with nitric oxide and air, and then extracted in aqueous solution. In this way, overall sugar yields increased from 17% for the case of no pretreatment to 70%. The glucose yield increased from 20 to 60%. Xylose, a potentially valuable side product of the pretreatment, is obtained by dilute acid hydrolysis during the extraction stage in yields of 90 to 96%. A preliminary design and cost analysis of the pretreatment-hydrolysis scheme indicates that glucose can be produced at 10.86 cents per pound, exclusive of straw cost. The corresponding cost per pound of total sugars produced is 5.0 cents. Sensitivity analyses indicate that 42% of the pretreatment cost (excluding hydrolysis) can be attributed to nitric oxide production, and the high yield of sugar obtained is advantageous when considering the cost of straw. DOE

N79-28270# City Univ. of New York, N. Y. Dept. of Chemistry.
NUCLEAR AND RADIOCHEMICAL TECHNIQUES IN CHEMICAL ANALYSIS Progress Report, 1 Aug. 1977 - 31 Jul. 1978
Harmon L. Finston and Evan T. Williams Jul. 1978 32 p refs
(Contract EY-76-S-02-3126)
(COO-3126-38) Avail: NTIS HC A03/MF A01

The study of neutron-absorption cross sections of reactor produced radionuclides was completed, and results are reported for Na-22, I-126, Ce-139, Y-88, Re-184, Ta-182, Mn-54, and Zr-94. The results for Na-22 indicate the existence of a resonance in the thermal region which could explain the discrepancies in the published values for the thermal cross section. The results of air-sampling experiments are described as is a proton-induced X-ray emission system. Other activities reported include work on sample preparation and applications of the PIXE technique, progress on a nuclear method to determine fluorine-containing gaseous compounds, solvent extraction with propylene carbonate, and experiments involving an acid-base hypothesis. DOE

N79-28271# Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex.
ACCURACY AND PRECISION OF LIQUID CHROMATOGRAPHIC ANALYSIS
G. D. Simpson Feb. 1979 6 p refs
(Contract EY-76-C-04-0789)
(MHSMP-79-12) Avail: NTIS HC A02/MF A01

The various factors affecting the accuracy and precision of the analytical results of liquid chromatographic analysis include solvent composition, care of the filter for the reciprocating pumps, temperature, data acquisition, column efficiency, sample injection, and turbulence associated with the detectors. Corrective measures and recommendations for increased quality of results are included. DOE

N79-28272# Research Inst. of National Defence, Stockholm (Sweden).
BALANCE PHASES IN THE SYSTEMS B-C, B-Si AND B-C-Si. A LITERATURE INVESTIGATION [JAEMVIKTSFASER I SYSTEMEN B-C, B-Si OCH B-C-Si. EN LITTERATURUNDERSOEKNING]
Fredrik Hopfgarten and Bo Holmberg May 1978 25 p refs In SWEDISH
(FOA-C-20240-D6) Avail: NTIS HC A02/MF A01

Based on a perusal of the literature, an evaluation is given of the phase relations in the systems B-C, B-Si and B-C-Si. The system B-C includes several phases, though they have only narrow regions of existence. Only one phase is congruently fusing, that is B13C2 (rhombohedral boron carbide). The boron carbide with the highest carbon content has the composition B13C3. At least two further phases exist in the boron-rich part of the system. In the system B-Si there exist B6Si and a rhombohedral boron silicide having a definite stoichiometry, somewhere in the region of composition B3Si - B4Si. At least one boron silicide richer in boron exists. The system B-C-Si is lacking in ternary compounds. R.E.S.

N79-28273# KVB Engineering, Inc., Tustin, Calif.
APPLICATION OF COMBUSTION MODIFICATIONS TO INDUSTRIAL COMBUSTION EQUIPMENT (DATA SUPPLEMENT A) Report, Jan. 1976 - Jan. 1978
K. T. Fisher, H. J. Buening, W. A. Carter, P. K. Engel, and S. C. Hunter Feb. 1979 504 p
(Contract EPA-68-02-2144)
(PB-293888/4; KVB-6002-734A-1; EPA-600/7-79-015B) Avail: NTIS HC A22/MF A01 CSCL 21B

Raw data from a study of the effects of combustion modifications on air pollutant emissions from a variety of industrial combustion equipment are provided. Tested were 22 units, including refinery process heaters; clay and cement kilns; steel and aluminum furnaces; boilers burning black liquor, woodbark, and CO gas; internal combustion engines; and gas turbine combined cycles. Process variables, fuel types, excess air reduction, burner adjustments, and staged combustion were evaluated primarily for their effect on NOx emissions. Emissions of NOx, SOx, CO, and HC were measured on all units. Emissions of particulate mass and size, trace species, and organics were measured on selected units. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N79-28274 California Univ., Berkeley.
DEVELOPMENT OF THE HIGH-TEMPERATURE, SOLID-STATE ELECTROMOTIVE FORCE TECHNIQUE TO STUDY THE THERMODYNAMICS OF LEWIS-ACID-BASE TRANSITION METAL ALLOYS Ph.D. Thesis

Gary Lloyd Bullard 1978 150 p
Avail: Univ. Microfilms Order No. 7914554

The basic principles of the Engel-Brewer theory of metals are summarized and illustrated. The theory predicts the extreme stability of the Lewis-acid-base alloys. The thermodynamics of such alloys may be obtained through the use of oxide-electrolyte, electrochemical cells. Experimental techniques associated with the use of these cells are explained. The physical processes which create the cell EMF are clearly identified. The fundamental understanding afforded by the resulting cell model implies the procedures used to both discover and eliminate errors. Those due to concentration overpotentials, reactive impurities in the gas phase, and interfacial reactions are carefully analyzed. The procedures used to test for and attain equilibrium in an alloy-oxide, powder compact are supported through identification of the transport processes that mediate equilibration.

N79-28275 Illinois Univ. at Urbana-Champaign.
INVESTIGATION OF OSCILLATIONS IN THE CATALYTIC OXIDATION OF HYDROGEN ON NICKEL Ph.D. Thesis
Gray Thomas Renola 1979 285 p
Avail: Univ. Microfilms Order No. 7915415

The temperature behavior resulting from the oxidation of hydrogen on a catalytic nickel foil under hydrogen-rich conditions was studied in a nonisothermal tubular reactor at atmospheric pressure. Among the observed behavior were self-sustained oscillations of the single-peak, multipeak, and chaotic type. The latter type were sustained in time but did not show a periodic pattern. Hysteresis and multiple oscillatory states were also observed. In an analytical investigation into these phenomena, a five-step kinetic mechanism was proposed which accounted for the oxidation-reduction of the nickel surface and the chemisorption and reaction of hydrogen and oxygen on the metal oxide. A spectral analysis was performed on the experimental and theoretical multipeak and chaotic oscillations. Dissert. Abstr.

N79-28276 California Univ., Berkeley.
FINITE ELEMENT ANALYSES OF PLASTIC DEFORMATION IN METAL FORMING PROCESSES Ph.D. Thesis
Chen-Chien Chen 1978 309 p
Avail: Univ. Microfilms Order No. 7914565

Metal forming processes of extrusion, drawing, ring compression, and closed-die forging were analyzed by the rigid-plastic finite element method. The method was modified in order to deal with the steady state configurations of the extrusion and drawing problems, the neutral flow point problems of ring compression, and the complexity in geometric changes of the closed-die forging problems. It was concluded that this modified finite element scheme does provide a useful tool for the analysis of neutral flow problems and for industrial applications. Solutions for two extreme friction conditions were obtained and compared with the experimental observations. The possibilities of solving the extremely complex problems by the rigid-plastic finite element method were demonstrated. Dissert. Abstr.

N79-28277 California Univ., Berkeley.
SURFACE PLASMON EFFECTS IN METAL-BARRIER-META STRUCTURES Ph.D. Thesis
Daniel Po-wai Siu 1978 111 p
Avail: Univ. Microfilms Order No. 7914764

The interactions involving electron currents in normal metal-barrier-metal junctions and surface modes of excitations associated with the electrodes are investigated. The tunneling mechanism is treated using the transfer Hamiltonian concept, and is described by density operator evolution diagrams. Elastic and inelastic tunneling currents associated with time-varying electromagnetic fields in the junction are evaluated directly from the density matrix elements. For resonant interactions involving surface plasmons on metals, the electron tunneling can be enhanced and negative differential resistance is possible. These excitations provide efficient coupling up to a frequency at least as high as the plasma frequency. In this case where externally excited modes are involved the inelastic electron tunneling and surface plasmon emission can be stimulated. Gain at infrared and optical frequencies is possible. Dissert. Abstr.

N79-28278 Rutgers - The State Univ., New Brunswick, N. J.
THE RESPONSES OF COPPER SINGLE CRYSTALS AND ALUMINUM - COPPER ALLOY TO SHOCK LOADING Ph.D. Thesis
Ming-Guang Chen 1979 179 p
Avail: Univ. Microfilms Order No. 7916133

The structural changes induced by shock loaded copper single crystals were studied by electron microscopy, scanning electron microscopy, optical metallography, differential scanning calorimetry, X-ray diffraction etc. Several structural changes were observed in the shock loaded metal which were distinguishable from the conventinal slow strain rate deformation. The primary structural responses to shock loading in the copper single crystal were dislocation cell structure, micro-twinning, point defects and porosity. It was observed that these structural defects were affected by various physical variables such as shock pressure, compressive and reflected tensile shock waves and orientation of the single crystal. Shock loading was carried out on aluminum-copper samples which were heat treated prior to loading to three different aging conditions: under-aging, critical-aging and over-aging. Dissert. Abstr.

N79-28279 Purdue Univ., Lafayette, Ind.
EFFECT OF FORGING TEMPERATURE ON THE STRUCTURE AND MECHANICAL PROPERTIES OF LOW CARBON POWDER METALLURGY ASTROLOY Ph.D. Thesis
David Lee Milam 1978 116 p
Avail: Univ. Microfilms Order No. 7914931

Low Carbon Astroloy powder was Hot Isostatically Pressed (HIP) at 2215 - 2225 F (1213-1218 C) and upset forged at 1975 F (1079 C), 2025 F (1107 C), and 2100 F (1149 C). Room temperature tensile, 1400 F (760 C) tensile, and 1400 F (760 C), 85 Ksi (586 MPa) stress rupture tests were performed on both the forged and nonforged material. Phase extractions were carried out using standard extraction techniques. The phases were identified by X-ray diffraction, and precision lattice parameters were determined for each phase. Chemical analyses of the extracted phases were carried out using a nondispersive X-ray analyzer on a scanning electron microscope. Both scanning and transmission electron microscopes were used in the structural study. Dissert. Abstr.

N79-28280 California Univ., Berkeley.
CHARACTERISTICS OF METAL-OXIDE-METAL DEVICES Ph.D. Thesis
Mordehai Heiblum 1978 220 p
Avail: Univ. Microfilms Order No. 7914634

An integrated device with area comparable to that of the point-contact configuration approximately 10 to the -10th power sq cm named Edge MOM is reported. Fabrication methods and detection characteristics at DC and at 10.6, 3.39, and 0.6328 microns are described. A detailed description of the Edge MOM junction and its behavior under the influence of impinging radiation is given. An extension of the MOM to an MOMOM is suggested. In order to find the limitations of the MOMOM, hot-electron devices such as: MOM-vacuum-metal, MOM-semiconductor, and MOMOM were theoretically investigated. As a result a proposed structure with effective interaction area (10 to the -10th to 10 to the -8th power) sq cm and oxide thicknesses on the order of 10A is proposed, which might have a transfer ratio of 0.3-0.5. Different coupling mechanisms such as: wave-guiding, antenna, and surface-plasmon coupling are looked into and frequency limitations are estimated. Dissert. Abstr.

N79-28281 Illinois Univ. at Urbana-Champaign.
AN ANALYTICAL ELECTRON MICROSCOPE STUDY OF THE OMEGA PHASE TRANSFORMATION IN A ZIRCONIUM-NIOBIUM ALLOY Ph.D. Thesis
Nestor John Zaluzec 1979 324 p
Avail: Univ. Microfilms Order No. 7915450

An in-situ study of the as-quenched omega phase transformation in Zr-15 percent Nb was conducted between the temperatures of 77 and 300 K using analytical electron microscopy. The domain size of the omega regions was on the order of 30 A. No alignment of omega domains along <222> directions of the bcc lattice was observed and furthermore in-situ thermal cycling experiments failed to produce a long period structure of alternating beta and omega phase regions as predicted by one of the most recent theories of this transformation. During this investigation, several

techniques of microstructural analysis were developed, refined, and standardized. Dissert. Abstr.

N79-28282 Ohio State Univ., Columbus.
THE PASSIVITY OF IRON-CHROMIUM ALLOYS Ph.D. Thesis
Te-Lin Yau 1979 319 p
Avail: Univ. Microfilms Order No. 7916045

Iron-chromium alloys with chromium contents of 0, 5, 15, and 25.5 weight percent Cr were studied in 1N H2SO4 and 1N Na2SO4 (pH 3, 6.5 and 10) solutions by using electrochemical techniques and the Auger electron spectroscopy (AES). The AES results show that the composition of the passive film of the Fe-Cr alloys can be classified into two types: in the acid and the neutral solutions, the very thin outermost layers are the spinel iron-chromium oxides and the inner layers are the chromium oxides; in the basic solution, the relatively thick outermost layers are the iron oxides, the middle layers are the spinel iron-chromium oxides, and the inner layers are the chromium oxides. The AES results also indicate that those compounds may be non-stoichiometric. The AES results show that sulfur is incorporated into the passive film of the alloys. The sulfur content in the neutral and basic solutions is discussed. Dissert. Abstr.

N79-28283 California Univ., Berkeley.
HIGH RESOLUTION ELECTRON MICROSCOPY STUDIES OF Au-Ni SPINODAL ALLOYS Ph.D. Thesis
Chien-Kuo Wu 1978 107 p
Avail: Univ. Microfilms Order No. 7914819

Individual measurements were made of lattice fringe spacings of Au-Ni spinodal alloys which are sensitive to composition variations at the atomic plane level. Smooth and regular composition waves are obtained at an early stage of decomposition, and later stage coarsening results in larger amplitude fluctuations. This provides direct evidence of simultaneous decomposition and coarsening which agrees with theoretical predictions. An analysis of reaction kinetics and morphology suggests that decomposition is one dimensional, even after very long aging times. This behavior is the result of a large matrix strain enegy associated with the decomposition product and the slow decomposition kinetics due to low temperature aging (at 150 C). Dissert. Abstr.

N79-28284 British Library Lending Div., Boston Spa (England).
ELECTRODEPOSITION OF A CHROMIUM-VANADIUM ALLOY
N. S. Ionyceva and V. I. Ignatjev May 1979 14 p refs Transl. into ENGLISH from Koroze Ochr. Mater. (Czech.), v. 21, no. 4, 1977 p 73-74
(BLL-RTS-11728) Avail: British Library Lending Div., Boston Spa, Engl.

Chromium samples were alloyed to vanadium to improve the former physico-mechanical properties. Microanalysis revealed that the addition of vanadic acid to a chrome plating bath increases the current efficiency by 20 percent, and that coatings containing approximately 0.2 percent vanadium exhibit greater plasticity and less porosity than conventional chromium coatings deposited under comparable parameters. M.M.M.

N79-28285*# Harvard Univ., Cambridge, Mass. Div. of Applied Sciences.
CRYSTAL NUCLEATION IN GLASS-FORMING ALLOY AND PURE METAL MELTS UNDER CONTAINERLESS AND VIBRATIONLESS CONDITIONS Annual Summary
David Turnbull Jun. 1979 5 p refs
(Contract NAS8-32691)
(NASA-CR-161267) Avail: NTIS HC A02/MF A01 CSCL 11F

Crystal nucleation behavior in metallic alloys known to form glasses in melt quenching was characterized and from this characterization the possibility that massive amounts of certain alloys could be slow cooled to the glass state was assessed. Crystal nucleation behavior of pure liquid metals was examined experimentally, under containerless conditions, and theoretically. R.E.S.

N79-28286# Royal Aircraft Establishment, Farnborough (England).
THE EFFECT OF BRINELLING AND FRETTING FATIGUE ON THE FATIGUE LIFE OF ASSEMBLED MACHINE COMPONENTS
L. Kreitner Feb. 1979 135 p refs Transl. into ENGLISH of "Die Auswirkung von Reibkorrosion und von Reibdauerbeanspruchung auf die Dauerhaltbarkeit Zusammengesetzter Maschinenteile" Forschungshefte Forschungskuratorium Maschinenbau e.V., Frankfurt, Pt. 56, 1976
(RAE-LIB-TRANS-1998; BR68838) Avail: NTIS HC A07/MF A01

Fatigue tests were carried out on specimens of heat treatable steels and titanium alloys with and without fretting pads. The effect on fatigue performance of slip, surface pressure, lubricants, surface treatments, heat treatments and loading sequences were evaluated. It was found that the main damaging mechanism of fretting fatigue is the high alternating shear stresses induced in the contact (friction welded) points. Theoretical evaluation of the stress paths under these contact points gave good agreement between the directions of the main stress and the cracks which caused failure. The various methods of preventing fretting fatigue failures or reducing their damaging effect are outlined. A.R.H.

N79-28287*# Rensselaer Polytechnic Inst., Troy, N. Y.
DIFFUSION AND PHASE CHANGE CHARACTERIZATION BY MASS SPECTROMETRY Final Report
Mark E. Koslin and Frederick A. White Aug. 1979 111 p refs
(Grant NsG-1360)
(NASA-CR-3165) Avail: NTIS HC A06/MF A01 CSCL 11F

The high temperature diffusion of trace elements in metals and alloys was investigated. Measurements were made by high sensitivity mass spectrometry in which individual atoms were detected, and quantitative data was obtained for zircaloy-2, 304 stainless steel, and tantalum. Additionally, a mass spectrometer was also an analytical tool for determining an allotropic phase change for stainless steel at 955 C, and a phase transition region between 772 C and 1072 C existing for zircaloy-2. Diffusion rates were measured in thin (0.001' (0.0025 cm) and 0.0005' (0.0013 cm)) ribbons which were designed as high temperature thermal ion sources, with the alkali metals as naturally occurring impurities. In the temperature and pressure regime where diffusion measurements were made, the solute atoms evaporated from the ribbon filaments when the impurities diffused to the surface, with a fraction of these impurity atoms ionized according to the Langmuir-Saha relation. The techniques developed can be applied to many other alloys important to space vehicles and supersonic transports; and, with appropriate modifications, to the diffusion of impurities in composites. A.R.H.

N79-28288*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
STUDY OF AUSTENITIC STAINLESS STEEL WELDED WITH LOW ALLOY STEEL FILLER METAL
Forrest A. Burns and Ray A. Dyke, Jr. Jun. 1979 32 p
(NASA-TP-1460) Avail: NTIS HC A03/MF A01 CSCL 11F

The tensile and impact strength properties of 316L stainless steel plate welded with low alloy steel filler metal were determined. Tests were conducted at room temperature and -100 F on standard test specimens machined from as-welded panels of various chemical compositions. No significant differences were found as the result of variations in percentage chemical composition on the impact and tensile test results. The weldments containing lower chromium and nickel as the result of dilution of parent metal from the use of the low alloy steel filler metal corroded more severely in a marine environment. The use of a protective finish, i.e., a nitrile-based paint containing aluminum powder, prevented the corrosive attack. A.R.H.

N79-28289# Cambridge Univ. (England). Dept. of Engineering.
FRACTURE MECHANISMS IN TWO AUSTENITIC AND ONE FERRITIC STEEL Final Technical Report, Aug. 1976 - Dec. 1978
M. F. Ashby, R. J. Fields (NBS, Wash., D. C.), and T. Weerasooriya Dec. 1978 27 p refs
(Grant DA-ERO-76-G-060; DA Proj. 1T1-61102-BH-57)
(AD-A067593) Avail: NTIS HC A03/MF A01 CSCL 11/6

The mechanisms of fracture of round tensile specimens of

two austenitic stainless steels (types 304 and 316) and one ferritic steel (2 1/4 Cr-1 % Mo) have been studied. These new observations have been combined with published information to construct two types of fracture-mechanism diagrams which show the regions of dominance of each mechanism, and summarize the fracture observations between absolute zero and melting point. These diagrams may help in distinguishing between creep-brittle and creep-ductile batches of steel, and in the rational extrapolation of creep-rupture data. Author (GRA)

N79-28290# AeroChem Research Labs., Inc., Princeton, N. J.
KINETICS OF SOME METAL ATOM AND METAL FLUORIDE OXIDATION REACTIONS RELEVANT TO AIR FORCE TECHNOLOGY DEVELOPMENT Interim Report, 1 Feb. 1978 - 31 Jan. 1979
Arthur Fontijin Mar. 1979 19 p refs
(Contract F49620-77-C-0033; AF Proj. 2308)
(AD-A067587; AEROCHEM-TN-204; AFOSR-79-0433TR) Avail: NTIS HC A02/MF A01 CSCL 07/2

This experimental work is providing kinetic data on metal oxidation reactions for Air Force rocket propulsion and ramjet technology programs using the HTFFR (High-Temperature Fast-Flow Reactor) technique over the temperature range 300 to 1900 K. The reaction mechanisms and rate coefficients have been obtained from optical absorption and fluorescence measurements of the consumption of metal atoms or metal monoxide/monohalide radicals, as functions of pressure, oxidizer concentration, reaction time, and temperature; these variables are independently controlled. GRA

N79-28291# Naval Postgraduate School, Monterey, Calif.
AN INVESTIGATION OF RESIDUAL STRESS CHARACTERIZATION OF 7075-T6 ALUMINUM FOR APPLICATION IN FATIGUE ANALYSIS M.S. Thesis
Gary Leland Stuart Dec. 1978 39 p refs
(AD-A067580) Avail: NTIS HC A03/MF A01 CSCL 11/6

Residual stresses induced by a stress concentration have been shown to increase the fatigue life of materials. An experimental investigation was undertaken to establish a relationship which would allow for the prediction of local residual stresses at a notch from known geometrical stress concentration factors and applied loads. Notched flat plate specimens were tested utilizing photoelastic coatings for measurement of stress concentration factors and residual stresses. Handbook values for stress concentration factors were found to be accurate within seven percent for the geometrics tested. The residual stress characterization consisted of a plot of nominal stress versus residual stress. These plots predicted residual stresses to within ten percent of the measured values for typical flight load histories. Author (GRA)

N79-28292# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
ANALYTICAL REPRESENTATION OF THE CREEP AND CREEP-RUPTURE BEHAVIOR OF ALLOY 800H Final Report
M. K. Booker 1978 50 p refs Sponsored by DOE
(CONF-780609-8) Avail: NTIS HC A03/MF A01

The extensive use of Alloy 800 (including the 800H variety) in elevated-temperature applications requires that the mechanical properties of this material be well characterized and understood. Available creep and creep-rupture data for Alloy 800 are presented and analyzed. Results include mathematical models describing time and strain to rupture, time and strain to tertiary creep and creep strain-time behavior as functions of stress and temperature. DOE

N79-28293# Illinois Univ. at Urbana-Champaign, Urbana. Dept. of Metallurgy and Mining Engineering.
STRUCTURE AND DEFORMATION CHARACTERISTICS OF RHEOCAST METALS Interim Report, 24 Jun. 1977 - 23 Jun. 1978
R. Mehrabian, J. A. Sekhar, C. Y. Chen, G. J. Abbaschian, and D. G. Backman Jan. 1979 87 p refs
(Contract DAAG46-76-C-0046)
(AD-A068120; AMMRC-TR-79-2) Avail: NTIS HC A05/MF A01 CSCL 11/6

During the past two years a number of Thixoforging systems (reheat furnaces with pentrometers and heated dies adapted to existing hydraulic presses) were designed, constructed and operated. These include: Two laboratory apparatuses with 50-ton hydraulic presses and a pilot plant size system with a 200-ton forging press. The continuous Rheocasting apparatus was modified and located near the large press to permit direct transfer of partially solid charge material to the dies without going through a solidification and reheating cycle. Experiments on the high temperature slurry producer showed that primary solid particle size in Rheocast cobalt-base Haynes alloy 31 and 4340 low alloy steel are of the same size as primary dendrite arm spacings in conventional specimens solidified under identical cooling rates. A theoretical model previously developed for homogenization (solution) heat treatment of Rheocast structures was used in the heat treatment of 2024 aluminum alloy forged specimens. The specific phases in this alloy before and after homogenization heat treatment were identified using an Electron Microprobe. GRA

N79-28294# Naval Research Lab., Washington, D. C.
IMPROVEMENT OF ENVIRONMENTAL CRACK PROPAGATION RESISTANCE IN Ti-8Al-1Mo-1V THROUGH MICROSTRUCTURAL MODIFICATION Final Report
G. R. Yoder, L. A. Cooley, and T. W. Crooker 19 Mar. 1979 45 p refs
(RR0220148)
(AD-A069084; AD-E000298; NRL-MR-3955) Avail: NTIS HC A03/MF A01 CSCL 11/6

A study has been conducted to improve crack tolerance properties of Ti-8Al-1Mo-1V through microstructural modification. Alloy microstructure was modified relative to that associated with the currently used duplex anneal through variations in heat treatment. Measurements were made of (i) fatigue crack growth in air, (ii) stress-corrosion cracking in 3.5% aqueous sodium chloride solution, and (iii) corrosion-fatigue in 3.5% aqueous sodium chloride solution. Results indicate that relative to crack tolerance properties of the duplex-annealed microstructure, the beta-annealed Widmanstatten microstructure offers superior resistance on all three bases of comparison; specifically, a 40-fold improvement in fatigue crack growth resistance in ambient air, a doubling of stress-corrosion-cracking threshold, and a resistance to corrosion-fatigue which exceeds the fatigue crack growth resistance of the duplex anneal in ambient air. Micromechanistic interpretations are discussed as appropriate. Author (GRA)

N79-28295# Naval Research Lab., Washington, D. C. Thermostructural Materials Branch.
EFFECT OF NEUTRON IRRADIATION OF FATIGUE CRACK PROPAGATION IN TYPE 316 STAINLESS STEEL AT 649 C
D. J. Michel and H. H. Smith 14 Mar. 1979 17 p refs
(RR0221141)
(AD-A069085; AD-E000299; NRL-MR-3936) Avail: NTIS HC A02/MF A01 CSCL 11/6

The effect of fast neutron irradiation on the fatigue crack propagation performance of Type 316 stainless steel was investigated at 649 C and compared with previous results at 593 C. The results show that, during continuous cycling, no significant effect of irradiation on crack propagation rate was observed in annealed steel. The inclusion of a one minute hold time increased the crack propagation rates in the irradiated annealed steel when compared with the results at 593 C. Irradiation was found to increase the crack propagation rates in 20 percent cold worked steel during both continuous cycling and one minute hold time tests. Scanning electron microscopy (SEM) examination of the fracture surfaces of the unirradiated fatigue specimens revealed that intergranular carbide precipitation during testing at 649 C acted to delay the transition to a purely intergranular failure mode with hold time as previously observed at 5 minutes. GRA

N79-28296# Battelle Columbus Labs., Ohio.
INVESTIGATION OF REJUVENATION OF FATIGUE DAMAGE IN IN-718 Final Report, 1 Jan. 1976 - 31 Jan. 1978
Allan H. Clauer, Brian N. Leis, G. Hoover, and David A. Seifert Aug. 1978 115 p refs
(Contract F33615-76-C-5100)

(AD-A068333; AFML-TR-78-90) Avail: NTIS HC A06/MF A01 CSCL 11/6

This research program investigated the feasibility of rejuvenating the elevated temperature, low cycle fatigue (LCF) properties of a nickel base superalloy, IN-718. The starting material was bar extruded from vacuum-cast billets. The microstructure of the bar was quite heterogeneous, and was not representative of a typical wrought product. The study addressed the rejuvenation of both pre-crack initiation damage, and surface-connected cracks (post-crack initiation damage). The investigation included an evaluation of different surface finishing and coating procedures on simulated crack specimens to assess the most reliable approach for bridging surface-connected cracks. It was found that a combination of shot peening, physical vapor deposition of an IN-718 coating, and a final ceramic coating was able to bridge cracks and provide crack closure and bonding during HIP. Fatigue predamaged bars were given the rejuvenation processing along with undamaged control specimens, and the post-rejuvenation fatigue properties were compared with baseline properties. The results showed that the baseline properties were quite dependent on the rejuvenation process. GRA

N79-28297# Pratt and Whitney Aircraft, West Palm Beach, Fla. Government Products Div.

PLASTIC FLOW AND FRACTURE PROCESSES IN POWDER METALLURGICAL NICKEL-BASE SUPERALLOYS Annual Report, Mar. 1978 - Mar. 1979

C. C. Law and M. J. Blackburn Apr. 1979 53 p

(Contract F49620-77-C-0083; AF Proj. 2306)

(AD-A068909; PWA-FR-11749; AR-2; AFOSR-79-0612TR) Avail: NTIS HC A04/MF A01 CSCL 11/6

The use of fine-mesh powder has been suggested as a method to alleviate the non-metallic inclusion problems in current powder products. In the present study, -325 mesh MERL 76 loose powder was characterized in detail and the properties of the consolidation compared with those of the -80 mesh powder. Higher interstitial contents and some interesting powder microstructures have been observed in the -325 mesh powder. However, no influence of these powder variables on tensile and stress-rupture properties of either fine-grain or coarse grain consolidations has been observed. During the course of the first-year and the current second-year efforts in this program, notch-rupture has emerged as an interesting and poorly understood phenomenon. A major effort has, therefore, been directed to the elucidation of the rupture mechanism and to identify important variables. GRA

N79-28298# Rockwell International Science Center, Thousand Oaks, Calif.

MECHANICAL BEHAVIOR OF TITANIUM ALLOYS Final Report, 1 Feb. 1976 - 31 Jan. 1979

C. G. Rhodes and N. E. Paton Apr. 1979 126 p refs

(Contract N00014-76-C-0598)

(AD-A068810; SC5056.4FR) Avail: NTIS HC A07/MF A01 CSCL 11/6

Conditions for the formation of the alpha-beta interface phase in Ti-6Al-4V have been determined, and the influence of this phase on mechanical properties examined. In previously reported work, it was shown that tensile yield strength could be increased by increasing the interface phase width. In the current work, it was found that fatigue crack propgagation (FCP) resistance can also be improved by heat treatments which increase interface phase width. The improved FCP resistance was associated with an increase in secondary cracking, which propagated predominantly along alpha-beta interfaces, especially at higher stress levels. Fracture toughness was found to be relatively insensitive to interface phase width, so that treatments which improve both tensile yield strength and FCP resistance do not degrade fracture toughness. An influence on fracture toughness found in this study was banding of primary alpha particles parallel to the rolling direction. This type of microstructure exhibited a high fracture toughness for cracks propagating normal to the bands, and such effects appear to be larger than effects due to interface phase or volume fraction alpha. GRA

N79-28299# Bendix Corp., Kansas City, Mo.

CVD ALUMINUM PLATING ON STEEL Final Report

F. A. Clay Jan. 1979 17 p ref Revised

(Contract EY-76-C-04-0613)

(BDX-613-1933-Rev) Avail: NTIS HC A02/MF A01

A chemical vapor deposition process was developed that produces aluminum coatings capable of being anodized at 500 volts. This method was used to apply an anodized coating onto the interior of a complex-shaped part. Unrecycled TIBAL, one of the least pyrophoric of the alkyls, was used under the following optimum coating conditions: temperature, 260 + or -5 C; spray pressure, 345 + or - 35 KPa; and time, 2 to 3 hours. DOE

N79-28300# Oak Ridge Y-12 Plant, Tenn.

CORROSION TESTING TYPE HP 9-4-20-STEEL

A. G. Dobbins, J. W. Koger, and T. M. Mustaleski, Jr. 20 Feb. 1979 26 p refs

(Contract W-7405-eng-26)

(Y-2168) Avail: NTIS HC A03/MF A01

A type of stainless steel alloy was studied to determine some of its corrosion and stress-corrosion characteristics, especially after welding. Potentiodynamic-polarization studies established that pitting of the steel was most severe when the chloride ion concentration was high and the pH of the solution was low. Higher potentials (approaching 1 V) caused increased corrosion rates also. Pitting of the welded samples was not preferential to any part of the weld and was uniform on both the base metal and weld. Dead-weight stress-corrosion tests demonstrated that welding did not increase susceptibility of the alloy to stress corrosion. The specimens failed in a ductile manner from the increased tensile load as the cross-sectional area was reduced by dissolution of the metal in the corrosive solution. DOE

N79-28301# Brookhaven National Lab., Upton, N. Y.

APPLICATIONS OF SOME MICROSCOPIC, DIFFRACTION AND ABSORPTION TECHNIQUES TO THE STUDY OF METAL-HYDROGEN SYSTEMS

Michael A. Pick 1979 11 p refs Presented at Workshop on Analysis of Hydrogen in Solids, Albuquerque, N. Mex., 23 Jan. 1979

(Contract EY-76-C-02-0016)

(BNL-25689; Conf-790127-7) Avail: NTIS HC A02/MF A01

Several experimental techniques used to investigate metal hydrogen systems were examined. Included were: metallography and optical microscopy. A few examples of such work are shown and the results are discussed. DOE

N79-28302# Cornell Univ., Ithaca, N. Y.

POINT-DEFECT ANNEALING MECHANISM FOR STAGE 3 RECOVERY IN IRRADIATED OR QUENCHED TUNGSTEN

David N. Seidman Oct. 1978 8 p refs

(Contract EY-76-S-02-3158)

(COO-3158-65) Avail: NTIS HC A02/MF A01

Field-ion microscope (FIM) results on electron irradiated W are discussed. The FIM experiments conclude that stage 3 irradiated W is explained by the long-range migration of a vacancy and not a second slow self-interstitial atom. Other experiments illustrating effects of electron-irradiated W are described. DOE

N79-28303# Fracture Control Corp., Goleta, Calif.

NUCLEAR PRESSURE VESSEL STEEL DATA BASE

W. L. Server and W. Oldfield Dec. 1978 498 p refs Sponsored by Electric Power Research Inst.

(EPRI-NP-933) Avail: NTIS HC A21/MF A01

Data was collected in a computer data base for 7 base metals which include heat descriptions, manufacturing and fabrication information, chemistry, temperature-dependent regression analyses (tensile, charpy, and precracker charpy), and regression statistics. All entries in the data base are identified by a set of codes termed keywords. The conputer data base is presented for each material type, and all pertinent data are shown in both a graphical and tabular form. DOE

N79-28304# New Mexico Univ., Albuquerque. Technology Application Center.

HEAT RESISTANT NICKEL ALLOYS. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1977 - Apr. 1979

Gerald F. Zollars Apr. 1979 39 p Sponsored in part by NTIS

(NTIS/PS-79/0338/8) Avail: NTIS HC $28.00/MF $28.00

CSCL 11F

The cited articles from worldwide literature concern research and development of heat resistant nickel alloys. Topics covered include the microstructure, mechanical properties, cast alloys, powder metallurgy, precipitation hardening, and heat treatment. A significant number of Russian articles are cited. GRA

N79-28305# New Mexico Univ., Albuquerque. Technology Application Center.
HIGH STRENGTH ALUMINUM ALLOYS. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1974 - Apr. 1979
Gerald F. Zollars Apr. 1979 29 p Sponsored in part by NTIS (NTIS/PS-79/0339/6) Avail: NTIS HC $28.00/MF $28.00 CSCL 11F

The cited articles from the worldwide literature concern research on high strength aluminum alloys. Topics covered include mechanical properties, fracture strength, stress corrosion cracking, crack propagation, metal fatigue, precipitation hardening, and fatigue tests. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N79-28306 California Univ., Berkeley.
PHASE EQUILIBRIA OF POLYMER SOLUTIONS Ph.D. Thesis
Dahwei David Liu 1978 145 p
Avail: Univ. Microfilms Order No. 7914675

Perturbed-hard-chain theory is extended to obtain an expression for Henry's constant for a solute in a molten polymer. Theoretical calculations and data reductions are reported for a variety of solutes in low-density polyethylene, poly-isobutylene and polydimethyl siloxane in the range 25 - 300 C. These Henry's constants are important for design of devolatilization process, to remove trace components of volatile, possibly toxic, residual solvents or monomers. The extended theory is applied to phase equilibrium calculations for mixtures of ethylene and low density polyethylene. Two binary parameters are required for phase equilibrium claculation for pressures from ambient to 2,000 bars. These two parameters are determined from experimental data for the critical locus and for low pressure Henry's constants. For each phase, the concentration of ethylene and the molecular weight distribution of the polymer can be calculated at given temperature and pressure. Dissert. Abstr.

N79-28307* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CATALYTIC TRIMERIZATION OF AROMATIC NITRILES AND TRIARYL-s-TRIAZINE RING CROSS-LINKED HIGH TEMPERATURE RESISTANT POLYMERS AND COPOLYMERS MADE THEREBY Patent
Li-Chen Hsu, inventor (to NASA) Issued 26 Jun. 1979 30 p Filed 12 May 1977 Supersedes N77-32244 (15 - 23, p 3049) Division of US Patent Appl. SN-513613, filed 10 Oct. 1974, US-Patent-4,061,856
(NASA-Case-LEW-12053-2; US-Patent-4,159,262; US-Patent-Appl-SN-796263; US-Patent-Class-528-126; US-Patent-Class-260-37N; US-Patent-Class-260-42; US-Patent-Class-260-53; US-Patent-Class-544-193; US-Patent-Class-528-221; US-Patent-Class-528-223; US-Patent-Class-528-229; US-Patent-Class-528-227; US-Patent-Class-528-225; US-Patent-Class-528-127; US-Patent-Class-528-128; US-Patent-Class-528-336; US-Patent-Class-528-337; US-Patent-Class-528-338; US-Patent-Class-528-342; US-Patent-Class-528-331) Avail: US Patent and Trademark Office CSCL 07C

Triazine compounds and cross-linked polymer compositions are made by heating aromatic nitriles to a temperature in the range of from about 100 C to about 700 C, and preferably in the range of from about 200 C to about 350 C, in the presence of a catalyst or mixture of catalysts selected from one or more of the following groups: (1) organic sulfonic and sulfinic acids, (2) organic phosphonic and phosphinic acids, and (3)metallic acetylacetonates, at a pressure in the range of from about atmospheric pressure to about 10,000 psi and preferably in the range of from about 200 psi to about 750 psi. Aromatic nitrile-modified (terminated and/or appended) imide, benzimidazole, imidazopyrrolone, quinoxaline, and other condensation type prepolymers or their precopolymers are made which are trimerized with or without a filler by the aforementioned catalytic trimerization process into triaryl-s-triazine ring containing or cross-linked polymeric or copolymeric products useful in applications requiring high thermal-oxidative stability and high performance structural properties at elevated temperatures.

Official Gazette of the U.S. Patent and Trademark Office

N79-28308 California Univ., Berkeley.
LINEAR VISCOELASTIC PROPERTIES OF HOMOGENEOUS BULK POLYMERS Ph.D. Thesis
David Syhlih Soong 1978 247 p
Avail: Univ. Microfilms Order No. 7914774

The background concepts of transient network model for entangled monodisperse polymers were introduced. This transient network model was extended to describe polymers with various molecular weight distributions and different chain geometries. The success in extending the basic model into these complicated systems lends further credence to the validity of this simple molecular theory. Dissert. Abstr.

N79-28309 Akron Univ., Ohio.
EMULSION COPOLYMERIZATION OF STYRENE AND ACRYLONITRILE IN A LAMINAR-FLOW TUBULAR REACTOR Ph.D. Thesis
Terdthai Vatanathan 1979 260 p
Avail: Univ. Microfilms Order No. 7914317

A stainless steel laminar flow tubular reactor was used to produce several poly(styrene-coacrylonitrile) latexes continuously. The operating conditions were examined and the products obtained were analyzed for percent conversion, molecular weight distribution and particle size distribution. A mathematical model describing an emulsion copolymerization in a tubular reactor using moment equations and Smith-Ewart kinetics was formulated and solved numerically, utilizing the Crank-Nicolson finite differences scheme and successive over-relaxation iteration method. The model predicted the monomer concentration profiles, temperature profile, initiator concentration profile, and molecular weight distribution profile as a function of the operating conditions. The results matched the experimental data well above 50 percent conversion, but below 50 percent, the predicted conversion was up to 20 percent too high. Dissert. Abstr.

N79-28310 Rutgers - The State Univ., New Brunswick, N. J.
INVESTIGATION ON CONE-AND-PLATE RHEOMETRY OF CERAMIC SLIPS Ph.D. Thesis
Alfred Polar 1979 256 p
Avail: Univ. Microfilms Order No. 7916162

A Ferranti-Shirley cone-and-plate rheometer was used to determine the significance of the several types of rheograms that could be obtained with typical ceramic slip samples. Five progressive stages in the development of fracture under shear were identified. It was found that a ten percent excess sample volume around the edge of the cone reduced fracturing appreciably. The fracture under shear effect constituted a limitation in the use of the rheometer that had to be kept in mind when interpreting the results obtained. Rheograms were obtained using typical commercial glaze slips and sanitary ware casting slips. Equilibrium curves revealed the stability characteristics of the slips tested. The curves showed thixotropic zones at low shear rates. At still higher shear rates, dilatancy and rheopexy were evident in some instances. Dissert. Abstr.

N79-28311 North Carolina State Univ. at Raleigh.
LOCALIZED DEFORMATION OF POLYMERS AT LOW TEMPERATURES AND HIGH LOADING RATES Ph.D. Thesis
John Duncan Williams, III 1978 293 p
Avail: Univ. Microfilms Order No. 7915554

An experimental technique was developed for the torsional deformation of polymeric specimens at low temperature over a wide range of strain rates. High density polyethylene (HDPE)

deformed inhomogeneously by the formation of shear bands. A transition to adiabatic shear fracture was observed above a critical rate. Polycarbonate (PC) deformed homogeneously at very low strain rates and inhomogeneously at higher strain rates. No catastrophic shear was observed in PC. The size of the inhomogeneous zones of both polymers was a function of the deformation after the end of the yield drop. The shear fractures of HDPE differed from the fractures of PC in which a tensile mode dominated even when the fracture propagated in the shear band. Dissert. Abstr.

N79-28312 British Library Lending Div., Boston Spa (England).
THE INFLUENCE OF POLYMERIC ADSORPTION LAYERS ON THE PROPERTIES OF PIGMENTED SYSTEMS
Richard Laible May 1979 26 p refs Transl. into ENGLISH from Farbe Lacke (West Ger.), v. 84, no. 12, 1978 p 946-955 (BLL-RTS-11783) Avail: British Library Lending Div., Boston Spa, Engl.

The properties of pigmented paints such as color strength, scattering power, brightness, flow and settling behavior were examined. In the dispersion model of hydrophilic titanium dioxide and iron pigments in a hydrophobic binder system based on polystryene, chemically bonded polystyrene layers on the pigment particle surface which are produced by reaction of the pigments with polystyrene containing methoxysilane end groups, give rise to an extensive stabilization of the pigment particles against flocculation. The dispersion stabilizing effect of the chemically bonded polymer layer is associated with the compatibility with the binder medium as shown by investigation of the properties of wide ranging incompatible acrylate resin paint systems. M.M.M.

N79-28313# Royal Aircraft Establishment, Farnborough (England).
STUDIES IN THE GLASS TRANSITION REGION OF ACRYLONITRILE-ISOBUTYLENE COPOLYMERS
J. Ritter and E. Helm Jan. 1979 17 p refs Transl. into ENGLISH from Plaste Kaut. (East Ger.), v. 25, no. 1, 1978 p 5-8
(RAE-LIB-TRANS-1996; BR68216) Avail: NTIS HC A02/MF A01

Specific heats, over a range of temperatures, and glass transition temperatures were determined by differential scanning calorimetry for copolymers of isobutylene and acrylonitrile. Cohesive energy and free volume values were calculated and the dependence of T sub g on these parameters was estimated using known equations. R.E.S.

N79-28314*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DEVELOPMENT AND EVALUATION OF ELASTOMERIC MATERIALS FOR GEOTHERMAL APPLICATIONS Annual Report, Oct. 1977 - Dec. 1978
W. A. Mueller, S. H. Kalfayan, W. W. Reilly, A. H. Yavrouian, I. D. Mosesman, and J. D. Ingham 15 May 1979 45 p refs Prepared for NASA and DOE
(Contract NAS7-100)
(NASA-CR-158813; JPL-PUB-79-40; DGE/1026-2) Avail: NTIS HC A03/MF A01 CSCL 11G

A material was formulated having about 250-350 psi tensile strength and 30-80 percent elongation at 260 C for at least 24 hours in simulated brine. The relationship between these laboratory test results and sealing performance in actual or simulated test conditions is not entirely clear; however, it is believed that no conventional formation or casing packer design is likely to perform well using these materials. The synthetic effort focused on high temperature block copolymers and development of curable polystyrene. Procedures were worked out for synthesizing these new materials. Initial results with heat-cured unfilled polystyrene 'gum' at 260 C indicate a tensile strength of about 50 psi. Cast films of the first sample of polyphenyl quinoxaline-polystyrene block copolymer, which has 'graft-block' structure consisting of a polystyrene chain with pendant polyphenyl quinoxaline groups, show elastomeric behavior in the required temperature range. Its tensile strength and elongation at 260 C were 220-350 psi and 18-36 percent, respectively. All of these materials also showed satisfactory hydrolytic stability. A.R.H.

N79-28315*# IIT Research Inst., Chicago, Ill.
PROGRAM FOR PLASMA-SPRAYED SELF-LUBRICATING COATINGS Final Report
G. C. Walther Jul. 1979 81 p refs
(Contract NAS3-20827)
(NASA-CR-3163; D6146) Avail: NTIS HC A05/MF A01 CSCL 11H

A method for preparing composite powders of the three coating components was developed and a procedure that can be used in applying uniform coatings of the composite powders was demonstrated. Composite powders were prepared by adjusting particle sizes of the components and employing a small amount of monosaluminum phosphate as an inorganic binder. Quantitative microscopy (image analysis) was found to be a convenient method of characterizing the composition of the multiphase plasma-sprayed coatings. Area percentages and distribution of the components were readily obtained by this method. The adhesive strength of the coating to a nickel-chromium alloy substrate was increased by about 40 percent by a heat treatment of 20 hours at 650 C. S.E.S.

N79-28316*# Georgia Inst. of Tech., Atlanta.
SURFACE TEMPERATURES AND GLASSY STATE INVESTIGATIONS IN TRIBOLOGY, PART 2 Final Report
Scott S. Bair and Ward O. Winer Jul. 1979 80 p refs
(Grant NsG-3106)
(NASA-CR-3162) Avail: NTIS HC A05/MF A01 CSCL 11H

Measurements of lubricant shear rheological behavior in the amorphous solid region and near the liquid solid transition are reported. Elastic, plastic and viscous behavior was observed. The maximum yield shear stress (limiting shear stress) is a function of temperature and pressure and is believed to be the property which determines the maximum traction in elastohydrodynamic contacts such as traction drives. A shear rheological model based on primary laboratory data is proposed for concentrated contact lubrication. The model is Maxwell model modified with a limiting shear stress. Three material properties are required: low shear stress viscosity, limiting elastic shear modulus, and the limiting shear stress the material can withstand. All three are functions of temperature and pressure. S.E.S.

N79-28317# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
RHEOLOGY OF POLYMERIC LIQUIDS
1978 200 p refs Lecture held at Rhode-Saint-Genese, Belgium, 16-20 Jan. 1978
(VKI-Lecture-Series-1978-1) Avail: NTIS HC A09/MF A01

Lectures covering the field are presented. Relevant subjects such as birefringence contributions to polymer science, viscometry, and several kinds of rheometers are discussed. For individual titles, see N79-28318 through N79-28328.

N79-28318# Technische Hogeschool, Delft (Netherlands). Technology of Macromolecular Compounds Lab.
FLOW BIREFRINGENCE AND VISCOELASTICITY OF POLYMER MELTS
H. Janeschitz-Kriegl *In* Von Karman Inst. for Fluid Dyn. Rheology of Polymeric Liquids 1978 17 p refs (For primary document see N79-28317 19-27)
Avail: NTIS HC A09/MF A01

Time dependent behavior and the stress optical relationship of polymer melts are reviewed in a comprehensive lecture. Validity of the stress-optical rule n = Cp (where n and p are the tensors formed by the deviation components of the refractive index and the stress tensor) is discussed. An expression for the stress-optical coefficient C is given. Experimental determination of C starting from Lodge's proposal is described. Validity of the stress-optical rule in the vicinity of the glass transition is discussed. Addition of the entropy-elastic parameter to approximate nonnewtonian viscosity and the improved fit to extinction angle curves are shown. Author (ESA)

N79-28319# Technische Hogeschool, Delft (Netherlands). Technology of Macromolecular Compounds Lab.
MOULD FILLING AND SAMPLE BIREFRINGENCE IN INJECTION MOLDING
H. Janeschitz-Kriegl *In* Von Karman Inst. for Fluid Dyn. Rheology of Polymeric Liquids 1978 21 p refs (For primary document

see N79-28317 19-27)
Avail: NTIS HC A09/MF A01

A theory to predict stagnant layer thickness and the optical verification of predictions are discussed. A difference equation is constructed using some approximations. Two dimensionless variables are introduced describing boundary layer mold filling behavior. Birefringence distribution and its relation to mold filling processes is discussed in detail using an experimental polystyrene example. The optically perceptible layer at which the real glass-transition took place just at the end of the filling period is related to the growing layer thickness by the approximate relationship (Tg-Tm)/(Ti-Tm) where Tg is the glass transition temperature, Ti is inlet temperature, and Tm is mold temperature. Author (ESA)

N79-28320# Technische Hogeschool, Delft (Netherlands). Technology of Macromolecular Compounds Lab.

FLOW BIREFRINGENCE OF POLYMER MELTS: INSTRUMENTATION

H. Janeschitz-Kriegl and J. A. vanAken *In* Von Karman Inst. for Fluid Dyn. Rheology of Polymeric Liquids 1978 21 p refs (For primary document see N79-28317 19-27)
HC A09/MF A01

Birefringency measurement techniques for polymer melts are discussed and related to traditional viscometric measurement. Work was done mainly with the cone and plate apparatus in different versions so as to measure flow birefringence in all three planes relevant to shear flow and to cover the whole range of technologically interesting shear rates. The most interesting results are those obtained at low shear rates and those of transient flow for which conventional methods are less adapted. Measurement difficulties with a coaxial cylinder apparatus with closed rims at high shear rates and anomalous readings in a polyethylene sample are commented on.
Author (ESA)

N79-28321# Technische Hogeschool, Delft (Netherlands).

VISCOSITY AND FLOW BIREFRINGENCE OF POLYMER SOLUTIONS

H. Janeschitz-Kriegl *In* Von Karman Inst. for Fluid Dyn. Rheology of Polymeric Liquids 1978 20 p refs (For primary document see N79-28317 19-27)
Avail: NTIS HC A09/MF A01

An up to date review of studies concerning flow birefringence contributions to polymer solution is presented. The rate of the Maxwell constant to intrinsic viscosity, presented as a function of molecular weight, is discussed. The fit with the Gotlib and Svetlof theory, as shown in an example, is pointed out. Methods based on the dynamic behavior of molecules and the validity of the multiple-bead-spring model are reviewed. Recent progress in instrumentation is described including the use of viscometers for non Newtonian solutions. Author (ESA)

N79-28322# Eidgenoessische Technische Hochschule, Zurich (Switzerland).

CAPILLARY RHEOMETRY FOR POLYMER MELTS

Joachim Meissner *In* Von Karman Inst. for Fluid Dyn. Rheology of Polymeric Liquids 1978 18 p refs (For primary document see N79-28317 19-27)
Avail: NTIS HC A09/MF A01

Theory and practice regarding the use of capillary rheometers (CRM) with polymer melts is reviewed. Corrections for shear stress and for shear rate are described. The variations as a function of temperature and pressure along with energy consumption and thermal effects are discussed, fracture effects, thermal degradation effects, and cross linking are briefly reviewed. Author (ESA)

N79-28323# Eidgenoessische Technische Hochschule, Zurich (Switzerland).

MEASUREMENT OF LINEAR VISCOELASTIC MATERIAL FUNCTIONS

Joachim Meissner *In* Von Karman Inst. for Fluid Dyn. Rheology of Polymeric Liquids 1978 15 p refs (For primary document see N79-28317 19-27)
Avail: NTIS HC A09/MF A01

Linear viscoelasticity and its application to polymer melts are briefly reviewed. A theory is developed based on the superposition principle using Laplace transforms of the corresponding linear differential equations. Mechanical models and spectra are discussed. The combined constant strain rate, relaxation tests, and the use of the time temperature superposition principle are described. The use of forced harmonic oscillations for polymer liquids and some experimental problems are examined.
Author (ESA)

N79-28324# Eidgenoessische Technische Hochschule, Zurich (Switzerland).

ELONGATIONAL RHEOMETRY FOR POLYMER MELTS

Joachim Meissner *In* Von Karman Inst. for Fluid Dyn. Rheology of Polymeric Liquids 1978 13 p refs (For primary document see N79-28317 19-27)
Avail: NTIS HC A09/MF A01

A summary of the different experimental methods including an improved rotating clamp apparatus is given, and some test results are discussed in detail. An analog servocontrol system used to perform tests with an arbitrary strain history is described. The influence of interface and surface tension is briefly discussed. Author (ESA)

N79-28325# Eidgenoessische Technische Hochschule, Zurich (Switzerland).

RHEOGONIOMETRY OF POLYMER MELTS

Joachim Meissner *In* Von Karman Inst. for Fluid Dyn. Rheology of Polymeric Liquids 1978 17 p refs (For primary document see N79-28317 19-27)
Avail: NTIS HC A09/MF A01

Rheogoniometric measurements are reviewed. The Weissenberg rheogoniometer (WRG) principle is explained. Modification of the WRG for measurements on polymer melts and results obtained at constant shear rates are discussed. An electronically controlled servomotor makes it possible to impose any history of shear strain or stress on the sample being tested. Applications for the measurement of creep, recovery after creep, two-step creep, recovery after constant shear rate, shear oscillations with large amplitude, and rapid-strain tests are described.
Author (ESA)

N79-28326# Solvay et Cie, Brussels (Belgium).

RHEOLOGY AND INDUSTRIAL PROCESSING OF POLYMERS

J. C. Chauffoureaux *In* Von Karman Inst. for Fluid Dyn. Rheology of Polymeric Liquids 1978 14 p (For primary document see N79-28317 19-27)
Avail: NTIS HC A09/MF A01

The industrial processing of polymers is reviewed in reference to polymer rheological properties. Extrusion is treated in detail.
Author (ESA)

N79-28327# Imperial Coll. of Science and Technology, London (England). Dept. of Chemical Engineering and Chemical Technology.

RHEOLOGY OF POLYMERIC LIQUIDS

J. R. A. Pearson *In* Von Karman Inst. for Fluid Dyn. Rheology of Polymeric Liquids 1978 20 p refs (For primary document see N79-28317 19-27)
Avail: NTIS HC A09/MF A01

The flow of polymeric liquids is reviewed. The theory of polymer flow in confined channels is described. Temperature effects, sharp changes in channel geometry, inlet and exit flow effects, and the die swell effect are discussed. Extensional flow in fiber and thin film production is described. Scaling-up of polymer processes and dimensional analysis of model systems are also discussed. Author (ESA)

N79-28328# Imperial Coll. of Science and Technology, London (England).

RHEOLOGICAL APPLICATIONS IN POLYMER PROCESSING

J. R. A. Pearson *In* Von Karman Inst. for Fluid Dyn. Rheology of Polymeric Liquids 1978 15 p (For primary document see N79-28317 19-27)
Avail: NTIS HC A09/MF A01

Confined and unconfined polymer flow industrial applications are briefly reviewed starting with a mathematical description of the basic systems. Extrusion, flow into molds, fiber spinning, film casting, film blowing, etc., are examined. Author (ESA)

N79-28329# Dow Corning Corp., Midland, Mich.
FASIL INTEGRAL FUEL TANK SEALANTS, PART 1 Final Report, Sep. 1977 - Sep. 1978
O. R. Pierce, K. M. Lee, K. Rossknecht, and A. H. McHale Jan. 1979 40 p refs
(Contract F33615-77-C-5139)
(AD-A067889; AFML-TR-79-4009-Pt-1) Avail: NTIS HC A03/MF A01 CSCL 11/9

The objective of this three year program is the synthesis, formulation, and evaluation of fasil (fluoroalkylarylene-siloxanylene) copolymers as curing and non-curing seals for fuel containment in high performance aircraft. This portion of the program was concerned primarily with the synthesis of monomers but a brief examination of selected polymerization systems was also conducted. Polymers containing the silphenylene structure have attracted the attention of a number of workers over the past twenty years because their thermooxidative stability is superior to that of (Me2SiO)x. Copolymers of silphenylenes and dimethylpolysiloxanes were envisioned as materials possibly possessing the desirable properties of both parent systems and this was realized to a certain extent. Thus incorporating silphenylene units into polydimethylsiloxane decreases the tendency to split out cyclic oligomers in a hot environment but raises the Tg because silphenylene tends to be crystalline. GRA

N79-28330# Solar Turbines International, San Diego, Calif.
STUDY OF EROSION MECHANISMS OF ENGINEERING CERAMICS Interim Report
Mary Ellen Gulden Mar. 1979 24 p refs
(Contract N00014-73-C-0401)
(AD-A067778; RDR-1778-9; SR79-R-4061-09; ITR-7) Avail: NTIS HC A02/MF A01 CSCL 11/2

A MgF2 target was subjected to impact conditions from single particle to 10 to the 10th power impacts which simulated a natural dust environment (quartz particles) in the subsonic velocity regime. The function of particle size and velocity predicted by the 'elastic-plastic' impact model is followed for this system. Impact damage is characterized by a heavily deformed contact area between particle and target, with radial cracks propagating outward from the contact zone, and with subsurface lateral cracks propagating outward on planes nearly parallel to the surface. The laterally cracked material is responsible for most of the erosion loss. This type of damage is also consistent with the 'elastic-plastic' model. For a given particle size - velocity condition - the volume of material removed for a single impact can vary over three orders of magnitude. This large variation is due primarily to differences in particle orientations during impact which results from the irregular natural quartz particles. For these conditions there is not a significant difference between the amount of material removed for the first impact and for subsequent impacts on the damage area of the initial impact. The results imply that there is not an incubation period or damage enhancement effect for erosion in the 'elastic-plastic' impact response regime. Author (GRA)

N79-28331# Army Mobility Equipment Research and Development Command, Fort Belvoir, Va.
COOPERATIVE FIELD EVALUATION OF MIL-L-2104C LUBRICANT IN ENGINE AND HYDRAULIC APPLICATIONS Final Report, Jul. 1977 - May 1978
Paul J. Kennedy and Thomas C. Bowen Sep. 1978 50 p refs
(AD-A068144; MERADCOM-2258) Avail: NTIS HC A03/MF A01 CSCL 11/8

This report covers a cooperative, lubricants program conducted in conjunction with the developmental testing (DTII) of a new Family of Lightweight Engineering Construction Equipment, known collectively by the acronym, FAMECE. This equipment was of interest because MIL-L-2104C engine oil served as a universal lubricant for engine, transmission, and hydraulic systems. The use of the Grade 10 oil as an Army hydraulic fluid was of particular interest. The overall objective of the program was to obtain base-line data on field application of MIL-L-2104C engine oil for use in future modification of the MIL-L-2104 engine oil specification. This report covers the laboratory evaluation of used oils collected during DTII and the investigation of fuel-related problems encountered during tests. Data indicate satisfactory oil performance. GRA

N79-28332# Dayton Univ. Research Inst., Ohio.
ENVIRONMENTAL DURABILITY TESTING OF STRUCTURAL ADHESIVES. PART 1: AF-143-2/EC-3917; PL-729-3/PL-728 Interim Technical Report, Jan. 1976 - Dec. 1977
D. Robert Askins Dec. 1978 74 p refs
(Contract F33615-76-C-5034; AF Proj. 7381)
(AD-A068378; UDR-TR-78-09-Pt-1; AFML-TR-78-35-Pt-1)
Avail: NTIS HC A04/MF A01 CSCL 11/1

A program has been conducted to investigate the durability of two modified epoxy adhesives in an elevated temperature, high humidity environment while under stress. For shear stress levels low enough to preclude fracture of the adherend surface oxide layer, and for aging times of less than 2400 hours, no significant difference exists in the time-to-failure behavior of the two adhesives. At higher stress levels, however, where fracture of the adherend surface oxide layer is likely, the adhesive system containing a rubber-filled primer (PL-729/PL-728) produced significantly longer times-to-failure than the adhesive system containing a non-rubber-filled primer (AF-143/EC-3917). Evidence was also developed to indicate that the presence of the rubber filler in the PL-728 primer gives rise to a thin boundary layer along the adherent oxide surface along which fracture occurs on specimens in which the adherends have been phosphoric acid anodized. GRA

N79-28333# Dayton Univ. Research Inst., Ohio.
ENVIRONMENTAL DURABILITY TESTING OF STRUCTURAL ADHESIVES. PART 2: BR-127/FM-1 Interim Technical Report, May 1976 - May 1978
D. Robert Askins Dec. 1978 42 p refs
(Contracts F33615-76-C-5034; F33615-78-C-5002; AF Proj. 7381)
(AD-A068379; UDR-TR-78-53-Pt-2; AFML-TR-78-35-Pt-2)
Avail: NTIS HC A03/MF A01 CSCL 11/1

A program has been conducted to investigate the durability of a 250 F (121 C) curing modified epoxy structural adhesive in an elevated temperature, high humidity environment while under stress. The results indicated that, for shear stress levels low enough to preclude fracture of the adherend surface oxide layer (below 2000 psi (13.9 MPa)), the FM-123-2/BR-127 adhesive/primer system provides long-term durability at 120 F (49 C) and 95-100% R.H. on both phosphoric acid anodized (PAA) and optimized Forest Products Laboratory (OFPL) etched surfaces. The change in slope of the environmental stress-rupture time-to-failure curve for the PAA specimens seems to correlate well with the stress level at which oxide fracture would be expected to occur (about 3000 psi (20.65 MPa)) and may indicate a different degradation mechanism above this stress level than below. The effect of temperature upon the durability of the adhesive joints tested in this investigation is to reduce durability with increasing temperature, as was to be expected. At higher aging temperatures, the interface seems to be more susceptible to degradation than the adhesive, while at lower temperatures the reverse is true. GRA

N79-28334# Physics International Co., San Leandro, Calif.
THERMOSTRUCTURAL RESPONSE OF CERMET ANNULI AND RINGS Final Report, 15 Dec. 1977 - 15 Nov. 1978
E. V. Buck and James Shea 15 Nov. 1978 111 p refs
(Contract DNA001-78-C-0068)
(AD-A068496; AD-E300510; PIFR-1148; DNA-4689F) Avail: NTIS HC A06/MF A01 CSCL 11/2

Thermostructural response experiments have been performed on annuli and rings of cermet. Thermal loading was produced by energy deposition of a pulsed electron beam. The thermostructural response was monitored by strain gauges and a high speed movie camera. The loading conditions were determined from electron beam diagnostics and from quartz pressure transducer records. Specimens were subjected to doses ranging from 58 cal/gm to 440 cal/gm. Front surface material was removed with doses in excess of 100 cal/gm. One ring was fractured. GRA

N79-28335# Bendix Corp., Kansas City, Mo.
STRESS RELIEF OF CERAMIC COMPONENTS IN HIGH VOLTAGE ASSEMBLIES Final Report
R. J. Heinen Feb. 1979 25 p refs
(Contract EY-76-C-04-0613)

(BDX-613-2105-Rev) Avail: NTIS HC A02/MF A01

Two types of ceramic packages were evaluated to determine the effectiveness of encapsulating the ceramic components in beta eucryptite filled epoxy. The requirements (no high voltage breakdown, no ceramic cracking, and no encapsulant cracking) were met by the spark gap assembly, but the sprytron assembly had cracking in the encapsulant after thermal cycling. The encapsulation of the ceramic component in beta eucryptite filled epoxy with a stress decoupling material selectively applied to the stress concentrated areas were used to prevent cracking in the sprytron encapsulant. This method is proposed as the standard encapsulation process for high voltage ceramic components.

DOE

N79-28336# Wisconsin Univ. - Madison. Dept. of Physics.

POLYMER SURFACE COATINGS FOR DOWN CONVERSION OF UV RADIATION AND INHIBITION OF PHOTODEGRADATION Semiannual Technical Status Report, Jun. 1978 - Jan. 1979

W. M. Yen and H. Yu 27 Jan. 1979 7 p

(Contract EM-78-C-04-5308)

(ALO-5308-T1) Avail: NTIS HC A02/MF A01

Cerous 3 polymethacrylate (CPMA), prepared by saponifying a commercial polymethyl methacrylate (PLEXIGLAS) and subsequently neutralized with cerous nitrate, were cast into film from its ethyl acetate solution. The CPMA films were subjected to intense UV radiation in order to accelerate the solarization, and they were found to be substantially less susceptible to UV induced degradation than the control which was the film cast from polymethacrylic acid (PMA). A set of CPMA coated PLEXIGLAS films was then tested by the same method and the films with coating thickness of 5 micron were inhibitory to UV degradation although the surface density of cerous ion was not uniform. A solar simulator was installed and calibrated, and initial optical and aging measurements were made on a series of CPMA PLEXIGLAS films. An automated solarization test system is being installed.

DOE

N79-28337# California Univ., Berkeley.

ABRASIVE WEAR IN CERAMICS: AN ASSESSMENT

A. G Evans Jan. 1979 20 p refs Presented at Symp. on Ceramic Machining and Surface Finishing, Washington, D. C., 12 Nov. 1978

(Contract W-7405-eng-48)

(LBL-8608; Conf-781143-3) Avail: NTIS HC A02/MF A01

The mechanisms of material removal during abrasive wear were examined, and preliminary analyses presented. Emphasis was placed on the lateral fracture mechanism, in an attempt to elucidate both its realm of importance and the concomitant material removal rates. Thermal stresses induced by plastic penetration were a potential source of material removal, especially at low levels of the normal force.

DOE

N79-28338# California Univ., Livermore. Lawrence Livermore Lab.

EPOXY RESIN-ELASTOMER SYSTEM FOR FILAMENT WINDING

J. A. Rinde, E. T. Mones, R. L. Moore, and H. A. Newey Oct. 1978 28 p refs Presented at 34th Ann. Conf. of the Reinforced Plastic/Composite Inst., New Orleans, 29 Jan. 1979

(Contract W-7405-eng-48)

(UCRL-81245; Conf-790135-1) Avail: NTIS HC A03/MF A01

Tests characterizing an epoxy system that contains 5% rubber and is suitable for wet-filament winding are described. The resin is a bisphenol-A rubberized epoxy diluted with an aliphatic diglycidyl ether and cured with an aromatic amine. The viscosity and pot life were measured and the progress of cure was monitored so an optimum cure could be chosen. Mechanical tests were performed on the cured resin. The low viscosity (0.95 Ps.s) and long pot life (29.3 h) make for ease of processing. A cure cycle of 1.5 h at 90 C plus 2 h at 130 C gives a cured resin having a glass transition temperature of 104 C. The heat-cured material has a tensile strength of 76.1 MPa and a modulus of 2.43 GPa. Kevlar 49 composites of 60-, 65-, and 70 vol % fiber were prepared and tested. Results are presented and compared to two other Kevlar 49/epoxy composites.

DOE

N79-28339# Bendix Corp., Kansas City, Mo.

EVALUATION OF POLYSTYRENE BEAD FOAM AS AN ENCAPSULANT FOR ELECTRONIC PACKAGES Final Report

D. J. Fossey Jan. 1979 78 p refs

(Contract EY-76-C-04-0613)

(BDX-613-2021-Rev) Avail: NTIS HC A05/MF A01

Thermal stresses on solder joints using a thumb tack test are compared for polystyrene bead and polyurethane foam encapsulants and GMB/epoxy. Special transducer designs are used to measure thermomechanical stresses and deflections. Failure criteria for some of the electronic components involved are delineated. The mechanical properties of potting polystyrene bead foam is presented and compared with the properties of structural polystyrene bead foam. The thermomechanical load and deflection data and the transducers developed are aids for making stress analysis in other foam encapsulated units. Polystyrene bead foam is concluded to be a safe encapsulant for certain electronic packages, but polyurethane foam is not.

DOE

N79-28340# Bendix Corp., Kansas City, Mo.

CHARACTERIZATION OF CERAMIC SUBSTRATES Final Report

A. Laudel Feb. 1979 56 p refs Revised

(Contract EY-76-C-04-0613)

(BDX-613-2057-Rev) Avail: NTIS HC A04/MF A01

Techniques were developed to improve receiving inspection and in-process testing of 99.5% alumina substrates used for manufacturing hybrid microcircuits. Many of these tests were implemented into production; other tests were recommended for further development. The tests developed include scanning electron microscope (SEM) measurement of grain size; low angle light inspection for surface defects; non-contact thickness and camber test; dye penetrant check for porosity and cracks; and SEM inspection of surface finish in holes. The effect of raindrop (variation of light transmission through substrates) and polished high spot defects was determined.

DOE

N79-28341# Argonne National Lab., Ill.

NONDESTRUCTIVE EVALUATION TECHNIQUES FOR HIGH-TEMPERATURE CERAMIC COMPONENTS Quarterly Report, Oct. - Dec. 1978

Jan. 1979 15 p refs

(Contract W-31-109-eng-38)

(ANL/MSD-79-1; QR-5) Avail: NTIS HC A02/MF A01

The adequacy of several nondestructive evaluation techniques for the detection of flaws in SiC heat-exchanger tubing are discussed. Experimental results regarding adaptability to ceramic tubing and minimum detectable flaw size were obtained for conventional ultrasonic testing, acoustic microscopy, conventional and dye-enhanced radiography, holographic interferometry, infrared scanning and internal-friction measurements. The advantages and disadvantages of overload proof testing are discussed.

DOE

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power*, *20 Spacecraft Propulsion and Power*, and *44 Energy Production and Conversion*.

N79-28342* National Aeronautics and Space Administration. Pasadena Office, Calif.

HIGH PERFORMANCE AMMONIUM NITRATE PROPELLANT Patent

Floyd A. Anderson, inventor (to NASA) (JPL) Issued 19 Jun. 1979 7 p Filed 16 Dec. 1977 Supersedes N78-17230 (16 - 08, p 1003) Sponsored by NASA

(NASA-Case-NPO-14260-1; US-Patent-4,158,583; US-Patent-Appl-SN-861390; US-Patent-Class-149-19.4; US-Patent-Class-149-19.9; US-Patent-Class-149-20) Avail: US Patent and Trademark Office CSCL 20i

A high performance propellant having greatly reduced

hydrogen chloride emission is presented. It is comprised of: (1) a minor amount of hydrocarbon binder (10-15%), (2) at least 85% solids including ammonium nitrate as the primary oxidizer (about 40% to 70%), (3) a significant amount (5-25%) powdered metal fuel, such as aluminum, (4) a small amount (5-25%) of ammonium perchlorate as a supplementary oxidizer, and (5) optionally a small amount (0-20%) of a nitramine.
Official Gazette of the U.S. Patent and Trademark Office

N79-28343 Pennsylvania State Univ., University Park.
SOME ASPECTS OF THE MECHANISM AND KINETICS OF COAL LIQUEFACTION Ph.D. Thesis
Adam J. Szladow 1979 185 p
Avail: Univ. Microfilms Order No. 7915743

The relationships between the generation of materials of different solubilities and the removal of oxygen functional groups for coal/tetralin interactions, at temperatures 340-400 C and relatively short times, were studied to provide quantitative information helpful in assessing various hypotheses about the role of oxygen functional groups in the early stages of liquefaction. Studies of the effect of temperature on rates of conversion were performed with the object of shedding additional light on the reactions taking place during short contact times. Mathematical treatment of the kinetics of complex reaction mixtures, specifically the analysis of activation energies were extended from what was known from the literature in order to apply it to coal liquefaction. Dissert. Abstr.

N79-28344 Colorado School of Mines, Golden.
KINETICS OF THE HYDRODENITROGENATION OF NITROGEN COMPOUNDS IN A COAL-DERIVED OIL Ph.D. Thesis
Vasantkumar Pragji Thakkar 1978 239 p
Avail: Univ. Microfilms Order No. 7912234

Seven commercial hydroprocessing catalysts were tested at 770 F and 1500 psig at LHSV's of 3.0/hr. The best catalyst for hydrogenitrogenation HDN of steady state recycle oil was a Ni, Mo/Al. The reaction kinetics for HDN were studied at LHSV's of 3.0, 1.5 and 0.5 and temperatures of 700, 750 and 800 F. Hydrogen pressure used was 1500 psig at a treatment rate of 3000 standard cubic foot per barrel of recycle oil. Second order rate kinetics for total nitrogen removal with an activation energy of 8.82 kcal/gmol were obtained. The kinetics of the HDN of carbazole was also studied under the same reaction conditions, resulting in first order reaction rate kinetics with activation energy of 12.33 kcal/gmol. Total nitrogen removal was modelled as two first order coupled reactions. An activation energy for the reactive group of nitrogen compounds was 9.99 kcal/gmol, and for the unreactive compounds was 12.33 kcal/gmol. Dissert. Abstr.

N79-28345*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ALTERNATE PROPELLANT PROGRAM, PHASE 1 Final Report
F. A. Anderson and W. R. West 1 Jul. 1979 161 p
(Contract NAS7-100)
(NASA-CR-158815; JPL-Pub-79-29) Avail: NTIS HC A08/MF A01 CSCL 21H

Candidate propellant systems for the shuttle booster solid rocket motor (SRM), which would eliminate, or greatly reduce, the amount of HCl produced in the exhaust of the shuttle SRM were investigated. Ammonium nitrate was selected for consideration as the main oxidizer, with ammonium perchlorate and the nitramine, cyclo-tetramethylene-tetranitramine as secondary oxidizers. The amount of ammonium perchlorate used was limited to an amount which would produce an exhaust containing no more than 3% HCl. R.E.S.

N79-28346# Committee on Commerce, Science, and Transportation (U. S. Senate).
LIQUEFIED NATURAL GAS: SAFETY, SITING, AND POLICY CONCERNS
Washington GPO 1978 156 p refs Rept. for Comm. on Commerce, Sci., and Transportation, 95th Congr., 2d Sess., Jun. 1978
(GPO-26-349) Avail: SOD HC

The policy concerns associated with liquid natural gas (LNG) import industry are discussed as well as the issues associated with LNG safety, siting, and regulatory factors. M.M.M.

N79-28347# Committee on the District of Columbia (U. S. House).
NATURAL GAS SHORTAGE
Washington GPO 1977 142 p Oversight hearings before the Subcomm. on Economic Development and Regional Affairs of the Comm. on the District of Columbia, 95th Congr., 1st Sess., 2 Mar. and 5 Apr. 1977
(GPO-86-231) Avail: Subcomm. on Economic Development and Regional Affairs

Testimony was given on the gas shortage that occurred during the winter of 1976-77, in the states served by the Columbia Gas Transmission Corporation. The management of local crisis as well as the economic impact of the shortage was discussed. Improvement on the coordination among local jurisdictions in preparing for other emergencies was stressed. M.M.M.

N79-28348# Committee on Commerce, Science, and Transportation (U. S. Senate).
DIESEL FUEL AND GASOLINE CONSERVATION ACT OF 1977
Washington GPO 1978 92 p refs Hearing on S. 1699 before the Comm. on Commerce, Sci. and Transportation, 95th Congr., 2d Sess., 14 Sep. 1978
(GPO-34-986) Avail: Comm. on Commerce, Sci. and Transportation

Testimony was given and a bill amendment was proposed to section 382 of the Energy Policy and Conservation Act of 1975 to alleviate current and continuing fuel waste, to reduce empty vehicle movements, and to increase efficiency in transporting goods by motor carriers which benefit consumers, and for other purposes. M.M.M.

N79-28349*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
USE OF REFINERY COMPUTER MODEL TO PREDICT FUEL PRODUCTION
Francisco J. Flores Jun. 1979 25 p refs
(NASA-TM-79203; E-088) Avail: NTIS HC A02/MF A01 CSCL 21D

Several factors (crudes, refinery operation and specifications) that affect yields and properties of broad specification jet fuel were parameterized using the refinery simulation model which can simulate different types of refineries were used to make the calculations. Results obtained from the program are used to correlate yield as a function of final boiling point, hydrogen content and freezing point for jet fuels produced in two refinery configurations, each one processing a different crude mix. Refinery performances are also compared in terms of energy consumption. A.R.H.

N79-28350*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
AXIAL JET MIXING OF ETHANOL IN CYLINDRICAL CONTAINERS DURING WEIGHTLESSNESS
John C. Aydelott Jul. 1979 43 p refs
(NASA-TP-1487; E-9937) Avail: NTIS HC A03/MF A01 CSCL 21D

An experimental program was conducted to examine the liquid flow patterns that result from the axial jet mixing of ethanol in 10-centimeter-diameter cylindrical tanks in weightlessness. A convex hemispherically ended tank and two Centaur liquid-hydrogen-tank models were used for the study. Four distinct liquid flow patterns were observed to be a function of the tank geometry, the liquid-jet velocity, the volume of liquid in the tank, and the location of the tube from which the liquid jet exited. Author

N79-28351# Congressional Budget Office, Washington, D. C.
REPLACING OIL AND NATURAL GAS WITH COAL: PROSPECTS IN THE MANUFACTURING INDUSTRIES
Aug. 1978 94 p refs
Avail: NTIS MF A01; SOD HC

The likely impact of alternative federal policies aimed at encouraging the use of solid coal instead of oil and natural gas in manufacturing industries is discussed. An overview of the oil

and gas consumption in the industrial sector is presented and the cost factors that enter into the selection of new boiler equipment and fuel are analyzed. Assumptions concerning future environmental regulations and cost data for air pollution control equipment are examined as well as the technical feasibility for coal substitution in nonboiler uses. Industrial demand for coal for boilers is estimated (if current policies were continued), and the sensitivity of these estimates to changes in key assumptions are specified. The effects of alternative coal substitution policies on energy use and on the federal budget are also assessed. A.R.H.

N79-28352# Air Force Engineering and Services Center, Tyndall AFB, Fla. Engineering and Services Lab.

CONTROL OF JP-4 EMISSIONS FROM UNDERGROUND STORAGE TANKS Interim Report, Jun. - Sep. 1978

Gordon A. Lewandowski and Thomas B. Stauffer Apr. 1979 31 p refs

(AD-A068991; AFESC/ESL-TR-79-03) Avail: NTIS HC A03/MF A01 CSCL 20/4

The South Coast Air Quality Management District, in southern California, is presently requiring controls on underground JP-4 tanks at March, Norton, and George AFB. It is expected that such controls may eventually be required at other Air Force installations. Therefore, an engineering study was undertaken to: (1) review the problem for Southern California and make recommendations where appropriate, and (2) determine the extent of the problem for the USAF as a whole. This report covers the first of these objectives. After visiting the above mentioned Air Force bases, and completing an engineering assessment of potential control strategies, low temperature refrigeration and recovery of condensed JP-4 vapors is recommended as the best control method. GRA

N79-28353# Atlantic Research Corp., Alexandria, Va. Research and Technology Div.

MODEL FOR STEADY-STATE COMBUSTION OF UNIMODAL COMPOSITE SOLID PROPELLANTS Interim Report

Merrill K. King Jan. 1978 14 p refs

(Contracts F49620-78-C-0016; F44620-76-C-0023; AF Proj. 2308)

(AD-A067585; AFOSR-79-0434TR) Avail: NTIS HC A02/MF A01 CSCL 21/9

A model for prediction of burning rate-pressure-crossflow velocity relationships for non-metalized composite propellants containing unimodal oxidizer, given only composition and oxidizer particle size, has been developed. This model embodies many of the concepts used in the Beckstead-Derr-Price model, but contains major modifications, including a postulated columnar diffusion flame bending mechanism for erosive burning. The major part of this paper is devoted to description and discussion of these modifications and to model development. Preliminary predictions of burning rate at various pressures and crossflow velocities have been made for a series of three 73/27 ammonium perchlorate (AP)/hydroxy-terminated-polybutadiene (HTPB) formulations, with oxidizer particle diameters of 5, 20, and 200 microns, and compared with data for these formulations. With optimization of three 'free constants' appearing in the model, it is found to give excellent agreement with no-crossflow burning rate data over the entire range of pressures and particle sizes studied. In all cases, however the predicted sensitivity of burning rate to crossflow velocity is somewhat less than observed experimentally. Author (GRA)

N79-28354# Textron Bell Aerospace Co., Buffalo, N. Y.

CHEMICAL AND METALLURGICAL ANALYSIS OF PROPELLANT STORAGE VESSELS Final Report, Mar. - Oct. 1978

E. J. King and H. G. Kammerer Feb. 1979 185 p refs

(Contract F04611-78-C-0012; AF Proj. 3059)

(AD-A068488; Rept-8795-927002; AFRPL-TR-79-6) Avail: NTIS HC A09/MF A01 CSCL 21/9

This report covers the examination and metallurgical evaluation of seven tanks after 5 to 8 years storage with N2O4 or ClF5 propellant. The tank materials included cryostretched 301 stainless steel and A-286 stainless steel. The cryostretched 301 stainless steel tanks had positive expulsion devices consisting of ring stiffened diaphragms of 304 stainless steel while the A-286 stainless tanks were unique in utilizing solid state, explosive bonds in place of fusion welds to join the tank components. Leakage by pitting corrosion was found in one positive expulsion 304 stainless steel diaphragm. In addition, deep pitting corrosion was found on the exterior shell of the cryostretched 301 tanks. The interior of the A-286 tanks showed a general, but rather shallow attack, probably from the HNO3/hf etching solution used to remove the heavy steel backup mandrels of the explosive bonding process. This general interior attack was somewhat accelerated in or near some of the bonds by the presence of crevices of local highly strained regions. Except for these problems, these two types of tanks performed quite satisfactorily during the extended storage with N2O4 or ClF5. GRA

N79-28355# Massachusetts Inst. of Tech., Cambridge. Energy Lab.

ESTIMATION METHODOLOGY FOR ENERGY SUPPLY FROM NATURAL RESOURCES Final Report

Esteban Hnyilicza Nov. 1978 429 p refs

(EPRI Proj. 871-1)

(EPRI-EA-788) Avail: NTIS HC A19/MF A01

The feasibility of developing improved methodologies for the estimation of reserves and for the forecasting of long term supply of subsoil energy resources was investigated. It was concluded that the development of improved tools for between the conceptual strengths of the economic theory of exhaustible resources and the relevance and realism of empirically based methodologies of model building. The application of the principles of systems science, so as to judiciously incorporate the geological, technological and behavioral determinants of resource exploitation, constitutes the most promising avenue toward achieving the above synthesis. Prototype models which serve to illustrate the potentialities of this methodology are presented. The models address the exploration and production of petroleum at the field and industry levels. DOE

N79-28356# Department of Energy, Washington, D. C. Energy Information Administration.

PETROLEUM SUPPLY/DEMAND ESTIMATES AND COST OF PETROLEUM IMPORTS, 1978-1980

Ercan Tukenmez and Cornelius Dwyer Dec. 1978 26 p refs

(DOE/EIA-0102/20) Avail: NTIS HC A03/MF A01

Results of the analysis show that petroleum imports to the 50-State/D.C area covered by the DOE import statistics are expected to average 8.1 to 8.3 million barrels daily in 1978. The cost of petroleum imports to the U.S. balance of payments area, including net imports to U.S. territories such as Puerto Rico and Virgin Islands is expected to be $44 to $45 billion in 1978, expressed in constant dollars observed in the first half of 1978. Imports into the 50-State/D.C area are expected to rise to the range of 9 to 9.4 million barrels daily in 1979 and to 10 to 10.6 million barrels daily in 1980. The cost of imports to the balance of payments area is expected to range between $49 to $51 billion in 1979 and between $54 and $57 billion in 1980 in the first half of 1978 dollars. DOE

N79-28357# North Dakota Univ., Grand Forks.

CHEMISTRY OF LIGNITE LIQUEFACTION Quarterly Report, Apr. - Jun. 1978

Virgil I. Stenberg, Richard J. Baltisberger, Kenneth J. Klabunde, Neil F. Woolsey, Donald Severson, and Max Souby Jul. 1978 50 p refs

(Contract EX-76-C-01-2211)

(FE-2211-10) Avail: NTIS HC A03/MF A01

Lignite liquefaction was investigated. Emphasis was placed on development of analytical methods for the structural analysis of solvent refined lignite (SRL) and its reduction products, application of the developed analytical methods to and CO-H2O reducing systems. Results are reported. J.M.S.

N79-28358# Institute of Gas Technology, Chicago, Ill.

RESEARCH AND DEVELOPMENT OF RAPID HYDROGENATION FOR COAL CONVERSION TO SYNTHETIC MOTOR FUELS Annual Report, 1 Apr. 1977 - 31 Mar. 1978

Dennis A. Duncan, Justin L. Beeson, and R. Donald Oberle Aug. 1978 101 p refs

(Contract EX-76-C-01-2307)

(FE-2307-34) Avail: NTIS HC A06/MF A01

Runs were made in the bench-scale unit using power plant grind of lignite and hydrogen. The main products obtained were methane, ethane, carbon oxides, and hydrocarbon liquids. The thermal treatment of the reactants for all runs was characterized by a kinetic severity function, which is a measure of the products of a first order decomposition rate constant and the time interval that the reactants are exposed to the reaction environment. Overall, correlation with kinetic serverity function was found to be a reasonable predictor for carbon conversion and methane yields. Initial work with liquids composition data shows that liquids composition does not correlate as well with kinetic severity function, indicating that other factors, such as reactions in sequence, influence liquids composition. DOE

N79-28359# Wolnak (Bernard) and Associates, Chicago, Ill.
TECHNOLOGY AND ECONOMICS OF CONVERSION OF CELLULOSE (WOOD) AND CORNSTARCH TO SUGARS, ALCOHOL AND YEAST Final Report
Bernard Wolnak Aug. 1978 253 p refs
(Contract ET-78-X-02-5007)
(COO-5007-1) Avail: NTIS HC A12/MF A01

The present status of the technology and economics for the production of glucose, alcohol, and yeast from cellulose (wood), corn starch, and molasses is analyzed. The basic processes for producing glucose and the factors affecting the economics of its production are reviewed. The costs of producing ethanol and yeast from the glucose are derived. Market availability of glucose, ethanol, and yeast is surveyed. DOE

N79-28360# Institute of Gas Technology, Chicago, Ill.
HYDROGEN FROM EXISTING FALLING-WATER SITES: AN INITIAL FEASIBILITY ASSESSMENT (SUMMARY)
Dale G. Johnson, William J. D. Escher, and Jon B. Pangborn 1978 11 p refs Presented at DOE Chem. Energy Storage and Hydrogen Energy Systems Contracts Rev., Washington, D. C., 28-30 Nov. 1978
(Contract EY-76-C-02-0016)
(CONF-781142-8) Avail: NTIS HC A02/MF A01

When viewed on a macroscopic scale, falling-water hydrogen cannot be a major contributor in strengthening the nation's energy base. However, when viewed on a regional or mini-regional scale, there appears to be strong possibilities that falling-water hydrogen can become an economic reality in the near term, as a high-value commodity that would serve as a replacement in part, for steam-reformed natural gas, and in the future, as an economic gas supplement through direct injection into the natural gas distribution system. Although appearing favorable, the characteristic seasonal-yearly variation in hydrogen production may or may not diminish the economic attractiveness of falling-water hydrogen. This will depend upon specific local market or energy demands and their relative location to the resource and the associated cost of storage and delivery. DOE

N79-28361# SRI International Corp., Menlo Park, Calif.
MISSION ANALYSIS FOR THE FEDERAL FUELS FROM BIOMASS PROGRAM. VOLUME 5: BIOCHEMICAL CONVERSION OF BIOMASS TO FUELS AND CHEMICALS
Jerry L. Jones, W. S. Fong, F. A. Schooley, and R. L. Dickenson Dec. 1978 203 p refs
(Contract EY-76-C-03-0015-131)
(TID-29093-Vol-5) Avail: NTIS HC A10/MF A01

In the analysis of the anaerobic digestion options, specific feedstocks, including animal manure, wheat straw, and marine algae (giant kelp), are considered on a case basis. The processes are described, investment and operating costs estimated, and the availability and reliability of the technology and environmental considerations briefly discussed. The analysis of the fermentation of biomass feedstocks to ethanol from sugars and the actual production of the sugars are described. After describing the process for fermentation of sugars to alcohol, estimating investment and operating costs, and commenting on the availability and reliability of the technology and environmental considerations, a number of alternative feedstocks and processes for producing the fermentable sugar solutions are examined. These processes for producing the sugar solutions are examined in a manner comparable with that mentioned above. The feedstocks included in the analysis are sugar cane, wheat straw, and aquatic biomass. DOE

N79-28362# Argonne National Lab., Ill. Materials Science Div.
MATERIALS TECHNOLOGY FOR COAL-CONVERSION PROCESSES Quarterly Report, Jul. - Sep. 1978
W. A. Ellingson 1978 71 p refs
(Contract W-31-109-eng-38)
(ANL-79-2; QR-15) Avail: NTIS HC A04/MF A01

An evaluation of ceramic refractories for slagging gasifiers and fused cast chrome alumina are presented along with ultrasonic erosion detection systems and data acquired during a plant run at Bi-Gas. DOE

N79-28363# Utah Univ., Salt Lake City. Dept. of Mining, Metallurgical and Fuels Engineering.
APPLIED RESEARCH AND EVALUATION OF PROCESS CONCEPTS FOR LIQUEFACTION AND GASIFICATION OF WESTERN COALS Quarterly Progress Report, Jul. - Sep. 1977
Wendell H. Wiser Apr. 1978 102 p
(Contract EX-76-C-01-2006)
(FE-2006-9) Avail: NTIS HC A06/MF A01

Studies on the extraction of coal with tetralin show that high volatile bituminous coal is converted to oil and benzene and pyridine solubles in less than 2 minutes. The products show systematic changes in hydroaromatic and aliphatic structures as the reaction proceeds. The presence of aromatic ring structures increases with reaction time. The molecular weight of liquid products decreases with reaction time. Mild hydropyrolysis appears to be a very interesting technique for upgrading coal-derived liquids to a lighter liquid. Hydrogen consumption in this process is low. Zinc chloride impregnated on coal was found to have hydrogen exchange properties of a Bronsted acid. A coal sample without $ZnCl_2$ has similar exchange properties, but the rate is much less. The acidic oil fraction obtained by catalytic hydrogenation of coal was separated by gel permeation chromatography and gradient elution liquid chromatography. Function group content was found to be independent of molecular size. DOE

N79-28364# Metal Properties Council, Inc., New York.
PROGRAM TO DISCOVER MATERIALS SUITABLE FOR SERVICE UNDER HOSTILE CONDITIONS OBTAINING IN MATERIALS FOR THE GASIFICATION OF COAL AND OTHER SOLID FUELS Quarterly Progress Report, 1 Jan. - 31 Mar. 1978
A. O. Schaefer, ed. May 1978 172 p
(Contract EX-76-C-01-1784)
(FE-1784-39) Avail: NTIS HC A08/MF A01

The materials for use in coal gasification plants with respect to the various unique corrosive environments were screened to provide useful corrosion data as well as reliable information on other properties needed for the design, construction, and operation of such plants. DOE

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N79-28365 Columbia Univ., New York.
APPLICATION OF DATA-BASED NONSTATIONARY RANDOM PROCESSES TO ENGINEERING MECHANICS PROBLEMS Ph.D. Thesis
Hidehiko Mitsuma 1979 102 p
Avail: Univ. Microfilms Order No. 7916435

The nonstationary process model developed is called data-based since it is constructed primarily on the basis of the observed record. The model is written in the form of the Fourier transform of the original record or of its symmetric-periodic extension with randomly shifted phase angles. Its construction is a straightforward task requiring only the Fourier transform of the original record or equivalently its Hilbert transform. The model lends itself to a tractable implementation of Monte Carlo analyses

because of the ease with which its sample functions are generated. Dissert. Abstr.

N79-28366 Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 11, NO. 1
Judith Nagle-Eshleman, ed., Ronald L. Eshleman, ed., and Milda Tamulionis, ed. Jan. 1979 108 p refs
(AD-A064432) Avail: SVIC, Code 8404, Naval Research Laboratory, Washington, D. C. 20375; $15.00/set CSCL 20/11

Methods for calculating fluid film bearing stiffness and damping coefficients are described. Mathematical formulations of a vibrating structure are presented as well as articles in the finite element modeling of structural vibrations. For individual titles, see N79-28367 through N79-28369.

N79-28367 Technical Univ. of Denmark, Lyngby. Dept. of Machine Elements.
EVALUATION OF STIFFNESS AND DAMPING COEFFICIENTS FOR FLUID-FILM BEARINGS c37
J. W. Lund *In* Shock and Vibration Inform. Center Shock and Vibration Dig., Vol. 11, No. 1 Jan. 1979 p 5-10 refs (For primary document see N79-28366 19-31)
Avail: SVIC, Code 8404, Naval Research Laboratory, Washington, D. C. 20375; $15.00/set

Methods for calculating fluid film bearing stiffness and damping coefficients are briefly described. Restrictions imposed by such assumptions as linearity are evaulated. Experimental methods used to obtain data necessary to determine the coefficients are presented. Author

N79-28368 Kaman Aerospace Corp., Bloomfield, Conn.
PARAMETER IDENTIFICATION TECHNIQUES FOR VIBRATING STRUCTURES c39
A. Berman *In* Shock and Vibration Inform. Center Shock and Vibration Dig., Vol. 11, No. 1 Jan. 1979 p 13-24 refs (For primary document see N79-28366 19-31)
Avail: SVIC, Code 8404, Naval Research Laboratory, Washington, D. C. 20375; $15.00/set

A description of mathematical formulations of a vibrating structure is presented and several categories of parameter identification are described. M.M.M.

N79-28369 Oklahoma Univ., Norman. School of Aerospace, Mechanical and Nuclear Engineering.
FINITE ELEMENT MODELING OF STRUCTURAL VIBRATIONS: A REVIEW OF RECENT ADVANCES c39
J. N. Reddy *In* Shock and Vibration Inform. Center Shock and Vibration Dig., Vol. 11, No. 1 Jan. 1979 p 25-39 refs (For primary document see N79-28366 19-31)
Avail: SVIC, Code 8404, Naval Research Laboratory, Washington, D. C. 20375; $15.00/set

A review of research is presented in the finite element modeling of structural vibrations, which concentrates on literature published on the vibrations of the basic structural elements, namely, beams, plates, and shells since 1967. M.M.M.

N79-28370* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THICKNESS MEASUREMENT SYSTEM Patent
Thomas A. Barr, inventor (to NASA) Issued 17 Jul. 1979 4 p Filed 31 Oct. 1977
(NASA-Case-MFS-23721-1; US-Patent-4,161,731; US-Patent-Appl-SN-847277; US-Patent-Class-343-14; US-Patent-Class-343-5NA) Avail: US Patent and Trademark Office CSCL 13I

An FM radar for the measurement of coal thickness wherein an FM transmitter is modulated by the combination of two signals; One, for example, could be a frequency of 100 Hz, and the other a frequency of 15 Hz. A horn-type antenna is used which is filled with a material having a dielectric constant approximating that of coal.

Official Gazette of the U.S. Patent and Trademark Office

N79-28371*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SRB-TPS SPRAY NOZZLE DEVELOPMENT FOR MSA-1 APPLICATION
Willibald Peter Prasthofer Jun. 1979 36 p
(NASA-TM-78231) Avail: NTIS HC A03/MF A01 CSCL 13H

Different overspray suppression schemes are presented. A spray nozzle system for the Marshall Sprayable Ablator (MAS-1) material was developed. As a result of the development for MAS-1 a substantial cost and time saving was achieved by permitting a continuous spray operation. S.E.S.

N79-28372# Textron Bell Aerospace Co., New Orleans, La.
AALC FAN MODEL TEST PROGRAM Final Report, 15 May 1978 - 8 May 1979
J. L. Allison 8 May 1979 212 p refs
(Contract N00014-78-C-0493)
(AD-A069058; Rept-7575-927031) Avail: NTIS HC A10/MF A01 CSCL 13/9

A 12-inch-diameter centrifugal fan impeller, which was a model of an existing full-scale air cushion vehicle (ACV) fan impeller, was tested in five different volute configurations including one which modeled another existing full-scale ACV installation. It was shown that the suitably scaled impeller could serve as a replacement for the other full-scale craft fans. Numerous velocity and pressure surveys were performed, and their results are discussed. GRA

N79-28373# Textron Bell Aerospace Co., New Orleans, La.
A STUDY OF REQUIREMENTS, MODEL CONFIGURATIONS, AND TEST PLANS FOR AIR CUSHION SYSTEM COMPARISON TESTS Final Report, 15 Aug. 1978 - 14 May 1979
J. Ryken 14 May 1979 40 p refs
(Contract N00014-78-C-0588)
(AD-A069006; Rept-7575-953032) Avail: NTIS HC A03/MF A01 CSCL 13/10

The Navy plans to test several models of air cushion vehicles with different cushion systems. A set of model design requirements suitable for all the models was developed by the Navy with the assistance of Bell Aerospace Textron and other contractors. The proposed DTNSRDC Model Test Program was reviewed. Minor changes and additions were suggested. A preliminary model configuration using Bell cushion philosophy was proposed. Ranges of bag and cushion pressures and airflows were established for the model. Two existing model fans from an existing model of the AALC JEFF(B) could provide the required nominal flow and pressure. Bell recommends installing four of these existing fans to permit testing over a wide range of flows. Cost and schedule estimates for the model detail design and construction were prepared. The schedule is shown in this report; cost estimates were provided under separate cover. GRA

N79-28374# Aerojet Liquid Rocket Co., Sacramento, Calif.
ACV CUSHION COMPARISON TESTS: PRELIMINARY REVIEW AND DEFINITION OF MODEL AND TESTS Final Report
Apr. 1979 30 p
(Contract N00014-78-C-0739)
(AD-A068888; ALRC-LCAC-2299-002) Avail: NTIS HC A03/MF A01 CSCL 13/10

The prime objective of this cushion comparison program is to be able to obtain data on the various existing cushion systems, that can be compared directly in the context of the amphibious assault mission. The use of a series of scale models, built and tested to a common standard, will provide a means of obtaining basic performance data that can be compared directly. The model is to be a dynamically similar representation of an air cushion vehicle (ACV) designed to the requirements of the Navy's amphibious assault mission. The purpose of the model is to provide data for the comparison of cushion systems. A linear scale factor of 1/12 full scale for the model was selected. The features considered most important are flexible skirt that contains the cushion, the lift fan system and the lift air distribution system together with the general hull form. The amphibious assault lift ships, that are to carry the ACV's, impose strict limits on the major dimensions of the craft. These are to be reflected in the model. GRA

N79-28375# Weidlinger Associates, Menlo Park, Calif.
NONLINEAR SOIL-STRUCTURE INTERACTION Final Report
J. Isenberg, D. K. Vaughan, and I. Sandler Dec. 1978 25 p refs
(EPRI-NP-945) Avail: NTIS HC A02/MF A01

Modeling research of constitutive properties of soil and of soil-structure interaction for nuclear power plants in earthquakes is presented. The models which were developed are general and can be used to simulate a three dimensional structural geometry, nonlinear site characteristics and arbitrary input ground shaking. The cap family of constitutive models of soils were extended to include earthquake effects. Also, the cap model was extended to include the effects of pore fluid on the seismic response of soils. Sensitivity of seismic induced soil structure interaction to the size of soil island was investigated. Two and three dimensional finite element simulations of the tests were performed and results were compared with measured data. DOE

N79-28376# Los Alamos Scientific Lab., N. Mex.
THE dc BREAKDOWN STRENGTH OF DIELECTRIC MATERIALS AT CRYOGENIC TEMPERATURES
P. Chowdhuri, T. R. Bement, C. N. Espinoza, and G. Weeks 1979 9 p refs Presented at the IEEE Transmission and Distribution Meeting, Atlanta, Apr. 1979
(Contract W-7405-eng-36)
(LA-UR-78-2403; Conf-790417-2) Avail: NTIS HC A02/MF A01

The HVDC superconducting cable will operate at a temperature of 12 K and a helium pressure of 1.38 MPa. Because dc breakdown data of dielectric materials at these operating conditions were not previously available, extensive tests were performed on 11 dielectric materials in sheet form. Three of these materials were impregnated with mineral oil, which increased their dc withstand strength significantly. Four of these 11 materials were selected for further tests at varying temperatures and pressures. The dc-breakdown field of cellulose paper (with and without oil impregnation) and PP/C (cellulose paper/polypropylene-cellulose paper) varied as the exponential of the inverse of temperature. DOE

N79-28377# California Univ., Livermore. Lawrence Livermore Lab.
METALLIC HYDROGEN RESEARCH
T. J. Burgess and R. S. Hawke Nov. 1978 29 p refs
(Contract W-7405-eng-48)
(UCID-17977) Avail: NTIS HC A03/MF A01

Theoretical studies predict that molecular hydrogen can be converted to the metallic phase at very high density and pressure. These conditions were achieved by subjecting liquid hydrogen to isentropic compression in a magnetic flux compression device. Hydrogen became electrically conducting at a density of about 1.06 g/cu cm and a calculated pressure of about 2 Mbar. In the experimental device, a cylindrical liner, on implosion by high explosive, compressed a magnetic flux which in turn isentropically compressed a hydrogen sample, coaxial conical anvils prevented escape of the sample during compression. One anvil contained a coaxial cable that used alumina ceramic as an insulator; this probe allowed for continuous measurement of the electrical conductivity of the hydrogen. DOE

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N79-28378 California Univ., Berkeley.
QUASI-STATIC ELECTRIC FIELDS, TURBULENCE AND VLF WAVES IN THE IONOSPHERE AND MAGNETOSPHERE Ph.D. Thesis
Michael Alexey Temerin 1978 163 p
Avail: Univ. Microfilms Order No. 7914789

An analysis of the effect of zero-frequency electric field turbulence on the output of an electric field double probe detector is applied to data from two satellites, OVI-17 and S3-3. The electric field of high latitude low frequency turbulence is polarized perpendicular to the magnetic field and the frequency as measured by the satellites is due to the Doppler shift of near zero frequency turbulence both in the ionosphere and magnetosphere is found. Rocket measurements of low frequency turbulence in the dayside auroral oval reveal characteristics similar to those of the large electric field regions recently seen on S3-3 indicating that the turbulence from those regions extends into the ionosphere. VLF waves were also observed during the two rocket flights into the dayside auroral oval. Dissert. Abstr.

N79-28379 California Univ., Berkeley.
ANALYSIS OF MULTI-CHANNEL ALOHA SYSTEMS Ph.D. Thesis
Wing-Po Yung 1978 168 p
Avail: Univ. Microfilms Order No. 7914827

A population of users communicating with a central station to a packet radio network, using the so-called slotted ALOHA random-access technique is considered. The performance of several multi-channel slotted ALOHA systems is explored. Two possible multi-channel structures are described: (1)a randomly multiplexed, K-channel slotted system in which a user can use, in any time slot, a fixed number of channels randomly chosen from the K available channels prior to transmission; and (2) a slotted system utilizing K independent ALOHA channels in which a user group is permanently assigned to a specific channel. Dissert. Abstr.

N79-28380 Columbia Univ., New York.
SMALL SIGNAL MODELING OF A CCD ANALOG DELAY LINE AND ITS APPLICATION Ph.D. Thesis
Hung-fai Law 1979 101 p
Avail: Univ. Microfilms Order No. 7916429

A small signal linear model for a charge coupled device (CCD) analog delay line is developed. An 8-level digital memory system using a commercial CCD analog delay line designed by using this model is presented. A linear system approach is used to derive the state variable diagram and the corresponding state vector equations from the physical characteristics of the CCD. The analytical impulse response of the delay line is obtained after the appropriate approximations are made in the equations. Experimental data agree with the theoretical analysis of the temperature and driving frequency effects on two of the model parameters. This model is used to predict the output of the CCD for two different input waveforms and the results are in good agreement with the experimental data. Dissert. Abstr.

N79-28381 California Univ., Santa Barbara.
AN INTEGRATED ANALOG SIGNAL PROCESSOR Ph.D. Thesis
Harry Victor Stephenson 1978 223 p
Avail: Univ. Microfilms Order No. 7915628

The basic element of the analog signal processor described is the integratable multifunction circuit. The design of the multifunction circuit makes use of a number of recent developments in solid state processing and device fabrication. The analog signal processor consists of a multifunction circuit, an operational amplifier and a reference voltage. The various functions are determined by external resistor values. Dissert. Abstr.

N79-28382 California Univ., Berkeley.
EVALUATION OF A REAL-TIME DISTRIBUTED PROCESSING SYSTEM Ph.D. Thesis
Ram Arieh Banin 1978 122 p
Avail: Univ. Microfilms Order No. 7914535

A system to serve as ARPANET's main Signal Processing Research facility to meet requirements of signal processing experiment it was necessary to provide on this system advanced capabilities for concurrent real-time acquisition, processing, storage and display of multiple data streams under interactive user control. A design for user interface and distributed monitor to overcome some of the software limitations is presented. The proposed software structure is intended to support a wide range of time-critical distributed processing applications such as: industrial process control, satellite data dissemination, energy control centers, etc. Dissert. Abstr.

N79-28383*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
SERIAL DATA CORRELATOR/CODE TRANSLATOR Patent Application
Larry Edward Morgan, inventor (to NASA) Filed 27 Jul. 1979 18 p
(NASA-Case-KSC-11025-1; US-Patent-Appl-SN-061327) Avail: NTIS HC A02/MF A01 CSCL 17B

A system is presented for analyzing asynchronous signals containing bits of information for ensuring the validity of said signals by sampling each bit of information a plurality of times and feeding the sample bits of information into a sequence controller. The sequence controller has a plurality of maps or programs through which the sample bits are stepped so as to identify the particular bit of information and determine the validity and phase of the bit. The step in which the sampling controller is clocked is controlled by a storage register. A data decoder decodes the information fed out of the sequence controller and storage register and feeds such information to shift registers for storage. NASA

N79-28384# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
UNSTABLE RESONATORS WITH SLIGHTLY MISALIGNED MIRRORS
C. Santana and L. B. Felsen (Polytech. Inst. of N. Y., Farmingdale) Jan. 1979 11 p refs
(Grant AF-AFOSR-3192-77)
(INPE-1414-RPE/002) Avail: NTIS HC A02/MF A01

Very small misalignments in unstable strip resonators may cause detachment of the low-loss eigenmode at lower equivalent Fresnel number, N sub eq, and introduce different periodicities into the eigenvalue curves as a function of N sub eq. Using the resonance equation derived previously from the waveguide mode theory, this behavior is explained in physical terms. A simplified explicit equation for the eigenvalue of the detached mode is derived and is found to predict correctly the periodicities of the eigenvalue oscillations. Author

N79-28385# Naval Ocean Systems Center, San Diego, Calif.
INTEGRATED REFRACTIVE EFFECTS PREDICTION SYSTEM (IREPS): INTERIM USER'S MANUAL Interim Report, Jul. 1978 - Feb. 1979
H. V. Hitney and R. A. Paulus Mar. 1979 51 p
(AD-A067984; NOSC/TD-238) Avail: NTIS HC A04/MF A01 CSCL 20/14

This document is an interim user's manual for the Integrated Refractive Effects Prediction System (IREPS). To provide a theoretical background for users of the system, electro-magnetic (EM) wave propagation in the lower atmosphere is reviewed in terms of naval radar, communications, and electronic warfare system performance. A discussion of surface-based ducts, elevated ducts, and evaporation ducts is included. Also included, is a survey of some tactical applications of atmospheric ducting to naval warfare. The operation portion of this document describes the IREPS. This provides a detailed description of the various IREPS products and how they are used to define optimum propagation conditions for a given EM system. Author (GRA)

N79-28386# Speech Communication Research Lab., Los Angeles, Calif.
ACOUSTIC/LINGUISTIC ASPECTS OF AUTOMATIC SPEECH RECOGNITION Final Report
David J. Broad Feb. 1979 39 p refs
(Contract F44620-74-C-0034)
(AD-A068969; AFOSR-79-0525TR) Avail: NTIS HC A03/MF A01 CSCL 17/2

As word-level automatic speech recognition has improved, there has been an increased awareness of the need for more general procedures to recognize extended continuous speech utterances. This project has therefore addressed several problems related to the recognition of continuous speech. This has involved the development of a flexible interactive software system for acquiring, labeling, and analyzing continuous speech. This system has been used to complete most of the other studies reported here, including (1) a statistical procedure for the automatic extraction of reliable formant measures from large-scale data bases, (2) an algorithm for segmenting continuous speech on the basis of spectral change, (3) a study of vowel formant distributions in relation to the inter-speaker normalization problem, (4) various studies of the properties of vowels and consonants, and (5) studies of the prosodic patterns of speech, particularly as they can guide the recognition of extended utterances. Author (GRA)

N79-28387# Grumman Aerospace Corp., Bethpage, N.Y.
LIGHTWEIGHT TRANSMITTER STUDY Technical Report, 31 Aug. - 30 Nov. 1978
Robert McGill Nov. 1978 85 p refs
(Contract N00173-78-C-0205)
(AD-A068952; PDR-699D-1) Avail: NTIS HC A05/MF A01 CSCL 17/9

The RF dependency of the Grumman procured UHF Transmit Modules is discussed in terms of various input parameters, RF amplitude and phase; pulse compression and antenna pattern quality are related via dc input characteristics. Tentative power supply designs are comparatively evaluated. The preferred configuration is used to develop estimates of watts/lb for current and 1985 technologies. GRA

N79-28388# Illinois Univ., Urbana. Electromagnetics Lab.
ANALYSIS OF OPEN DIELECTRIC WAVEGUIDES USING MODE-MATCHING TECHNIQUE AND VARIATIONAL METHODS Interim Report
R. Mittra, Y. Hou, and V. Jamnejad Mar. 1979 38 p refs
(Grant DAAG29-77-G-0111)
(AD-A068128; UIEM-79-8; UILU-ENG-79-2548; ARO-14686.3-EL) Avail: NTIS HC A03/MF A01 CSCL 09/1

The mode-matching technique is employed for computing the propagation constants and field distributions of an inverted strip dielectric waveguide. The results derived in this manner are further improved by using variational formulas expressly designed for open dielectric waveguides. Illustrative numerical results are presented and compared with experimental measurements as well as those based on approximate methods found in the literature. Author (GRA)

N79-28389# Harris Corp., Melbourne, Fla. Government Systems Group.
CODING FOR NAVY UHF SATELLITE COMMUNICATIONS (PHASE 2) Final Report
11 Aug. 1978 90 p refs
(Contract N00039-77-C-0259)
(AD-A069074; JA-1126) Avail: NTIS HC A05/MF A01 CSCL 22/2

The purpose of Phase II of the study was to confirm and extend the results of Phase I by experimental means. Specifically, our primary objectives in Phase II were: Implement a breadboard codec of the type recommended in Phase I. Carry out a comprehensive testing program with this codec, using the shipboard RFI simulator at the Naval Postgraduate School. Identify any performance limitations and interfacing constraints imposed by the requirement to interface with existing equipments. These objectives have been carried out, and the results are documented in this Final Report. GRA

N79-28390# Texas Technological Univ., Lubbock.
POWER SYSTEM ANALYSIS Final Report
T. R. Burkes, J. P. Craig, and D. L. Gustafson Jan. 1979 82 p refs
(Contract F29601-75-C-0111)
(AD-A068505; AD-E200267; AFWL-TR-78-16) Avail: NTIS HC A05/MF A01 CSCL 10/2

This report describes the system analysis performed on a lightweight, high-power power system. The system consists primarily of the turboalternator, rectifier/filter, and fault protection circuits. The determination of and effects from various alternator faults are described. Calculations for the filter weight and volume and a grounding and shielding scheme are presented. A design concept for a load protection crowbar is developed. Because a small, high voltage power supply is required for an electron-beam gun, methods of generating high voltages in small packages are reviewed. Also included is a review of the state of the art of lightweight power sources, including advanced conventional,

permanent magnet, and superconducting alternators, magnetohydrodynamic generators (MHD), and batteries. GRA

N79-28391# Science Applications, Inc., Berkeley, Calif.
A COUPLING MODEL FOR A PAIR OF SKEWED TRANSMISSION LINES Final Report
D. V. Giri, S. K. Chang, and F. M. Tesche Kirtland AFB, N. Mex. Air Force Weapons Lab. Feb. 1979 54 p refs
(Contract F29601-78-C-0002; AF Proj. 3763)
(AD-A069047; AD-E200293; AFWL-TR-78-164) Avail: NTIS HC A04/MF A01 CSCL 20/14

A coupling model in the form of an equivalent circuit is developed for a pair of skewed transmission lines. The inductive coupling is evaluated in closed form and the capacitance elements are obtained from the solution of a pair of coupled integral equations for the excess charge distributions. Parametric studies are carried out and the results are presented in graphical form. GRA

N79-28392# Texas Instruments, Inc., Dallas. Central Research Labs.
CCD PROCESSOR FOR InSb ARRAY Final Technical Report, 1 Jun. 1976 - 31 Oct. 1978
Robert J. Kansy Dec. 1978 130 p refs
(Contract N00173-76-C-0237; XF54583004)
(AD-A068910; TI-08-78-50) Avail: NTIS HC A07/MF A01 CSCL 09/5

A silicon integrated circuit employing n-channel MOS (NMOS) and charge-coupled device (CCD) circuits has been designed and fabricated for the purpose of interfacing with an InSb infrared detector array on the focal plane. The resulting focal plane array includes preamplification, correlated double sampling, and 16-element time-delay-and-integration (TDI) for each of 24 channels corresponding with the assumed 16 x 24 element detector array. The signals from individual channels are combined in a 24-channel output multiplexer. This report includes details related to the design of each circuit element and the results of subsequent evaluation. Key problem areas related to cryogenic application of standard analog NMOS circuits are reported and analyzed. It is concluded that NMOS circuitry is ideally suited for cryogenic applications, although further work is required to completely characterize alternative circuits. GRA

N79-28393# Ohio State Univ., Columbus. Electroscience Lab.
INFORMATION PROCESSING FOR TARGET DETECTION AND IDENTIFICATION Final Report
A. A. Ksienski Apr. 1979 15 p refs
(Grant AF-AFOSR-2611-74; AF Proj. 2304)
(AD-A068907; ESL-783815-8; AFOSR-79-0596TR) Avail: NTIS HC A02/MF A01 CSCL 17/9

This report summarizes the accomplishments attained under the grant. The goal was the development of automatic target classification techniques utilizing low frequency radar returns. Reliable classification techniques were developed and shown to be effective for a large variety of target shapes. In particular, a reliable performance has been shown for aircraft identification, where eight classes of combat planes, both American and foreign made, were tested. The problem of classifying an object as belonging or not belonging to a specified catalogue of classes was successfully solved and a simple and reliable implementation was devised. GRA

N79-28394# IIT Research Inst., Annapolis, Md.
WIDEBAND FDM/FM MICROWAVE RADIO RELAY PERFORMANCE DEGRADATION INVESTIGATION Final Report
Arecio A. Hernandez Apr. 1979 394 p
(Contract F19628-78-C-0006)
(AD-A068757; ESD-TR-79-100) Avail: NTIS HC A17/MF A01 CSCL 17/2

A general investigation of the performance degradation in FDM/FM systems when exposed to various types of interference signals was made through a combined use of detailed measurements and analyses. Several techniques are described for evaluating the performance degradation in FDM/FM systems. These techniques use a combination of measured data and engineering trends covering a reasonably complete range of receiver and interference parameters. The measurement methodology is also documented. GRA

N79-28395# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
THE EFFECT OF IONOSPHERIC SCINTILLATIONS FADING ON AIRCRAFT-TO-SATELLITE COMMUNICATIONS Final Technical Report, Jan. 1976 - May 1978
Allen J. Johnson Feb. 1979 174 p
(AF Proj. 1227)
(AD-A068758; AFAL-TR-78-171) Avail: NTIS HC A08/MF A01

Ionospheric scintillation fading on a UHF earth-to-satellite communication link has a strong dependence on season, time-of-day, and geographic location. In the equatorial region + or - 20 deg from the magnetic equator, 20 to 30 dB fades can be expected 1 to 2 hours after sunset during the equinox period. Airborne terminals may experience fade rates as fast as 1 fade per second to as slow as 1 fade in 90 seconds, depending on the direction of flight. The amplitude fading follows a power low distribution with a rate of F-2 to F-4 depending on fade rate. In the polar region an airborne terminal may experience ionospheric scintillation more often than near the equator but usually with less amplitude. Polar fading of 10 dB or less may occur 10 to 30% of the time. In the mid latitudes occasional random ionospheric scintillation may occur, but the fade depth and occurrence are so small as to pose only a minor annoyance to an airborne satellite communication system. GRA

N79-28396# Logicon, Inc., San Diego, Calif. Tactical and Training Systems Div.
SPEECH UNDERSTANDING IN AIR INTERCEPT CONTROLLER TRAINING SYSTEM DESIGN Final Report, Feb. - Nov. 1978
M. W. Grady, J. E. Porter, W. J. Satzer, Jr., and B. D. Sprouse Jan. 1979 73 p refs
(Contract N61339-78-C-0044)
(AD-A068612; NAVTRAEQUIPC-78-C-0044-1; Rept-3) Avail: NTIS HC A04/MF A01 CSCL 17/2

This report describes the requirements for a speech recognition and understanding system to support an automated training system for Air Intercept Controllers (AIC). A combined isolated word recognition (IWR) and limited connected speech recognition (LCSR) system was developed and tested in a laboratory AIC training system model. Speech stylization constraints were minimized, resulting in particularly challenging recognition requirements. Integration of the IWR and LCSR techniques proved difficult. Author (GRA)

N79-28397# City Coll. of the City Univ. of New York. Communications Systems Lab.
RESEARCH ON ADAPTIVE DELTA MODULATORS Interim Report, Mar. - Dec. 1978
V. R. Dhadesugoor, C. Ziegler, and Donald L. Schilling 15 Dec. 1978 75 p refs
(Contract MDA903-78-C-0182; ARPA Order 3534)
(AD-A068453; ARPA-TR-1) Avail: NTIS HC A04/MF A01 CSCL 09/3

In this report, the performance of the Song Mode Voice Adaptive Delta Modulator (SVADM) and the Continuously Variable Slope Delta MODULATOR (CVSD) are compared in terms of dynamic range, sampling rate and the channel errors. The use of the SVADM and the CVSD in a packet voice channel, the algorithms for digital detection of periods of silence and the performance of a packet voice channel using the SVADM and the CVSD as source encoders are presented. The parameters employed for subjective evaluation of the packet voice channel are packet size, silence detection algorithm, bit rate and packet loss rate. Author (GRA)

N79-28398# Sandia Labs., Albuquerque, N. Mex. Antenna Development Div.
SCATTERED EM FIELD DUE TO ROTATING BLADES OF HORIZONTAL-AXIS WIND MACHINES
Billy C. Brock Mar. 1979 35 p refs
(Contract EY-76-C-04-0789)
(SAND-79-0434) Avail: NTIS HC A03/MF A01

An analysis of the scattered electromagnetic field from the

rotating blades of a horizontal axis wind machine is presented. The general analysis includes all of the near field terms and does not specify the blade geometry. After the general result is developed, appropriate approximations were made and a simple blade geometry was specified in order to simplify numerical calculations. (The simple blade geometry includes blade pitch angle and coning angle). Graphs of the magnitude vs. time of the total horizontally polarized electric field resulting from a horizontally polarized incident plane wave are given for various parameters. The FORTRAN computer code used to generate the results is also listed. DOE

N79-28399# Fondazione Ugo Bordoni, Rome (Italy).
GENERAL CONSIDERATIONS ABOUT SPEAKER RECOGNITION FOR LEGAL USE [CONSIDERAZIONI GENERALI SUL PROBLEMA DEL RICONOSCIMENTO DEL PARLATORE A SCOPI LEGALI]
Italo Barducci (Rome Univ.), Giovanni Ibba, and Andrea Paoloni Aug. 1978 25 p refs In ITALIAN
(FUB-19-1978) Avail: NTIS HC A02/MF A01

Advances in the field of speaker recognition are considered. Various reports are discussed. In spite of considerable progress, more work is necessary if legal use is intended. Special difficulties involving the poor acoustic quality of telephonic recordings are mentioned. Author (ESA)

N79-28400# Fondazione Ugo Bordoni, Rome (Italy).
PARTIAL RESPONSE IN THE FDM-FM RADIO RELAY LINKS
Angelo Bernardini (Rome Univ.), Dario Dizenobio, and Gian Franco Meucci (Rome Univ.) Aug. 1978 5 p refs Presented at 6th Colloq. on Microwave Commun., Budapest, Aug. 1978
(FUB-20-1978) Avail: NTIS HC A02/MF A01

The efficient use of available frequency spectra for the successful introduction of medium capacity digital radio relay systems in telecommunication networks was investigated. Modulation methods for digital radio relay systems include the use of partial response (PR) coding techniques in connection with frequency modulation PR-FM system to reduce spectrum occupancy. A PR signal was assumed as the baseband signal for an FM system. The power density spectrum of the PR-FM signal was evaluated to determine if it is possible to use the apparatus of existing FDM-FM radio relay systems to carry digital information. Results show compatibility of the PR-FM digital signal with the present CCIR canalization. Author (ESA)

N79-28401# Fondazione Ugo Bordoni, Rome (Italy).
ANALYTICAL METHOD FOR THE PREVISION OF MULTIPATH FADING [METODI DI ANALISI PER LA PREVISIONE DELLA ATTENUAZIONE DOVUTA A CAMMINI MULTIPLI]
Giorgio Marcheti May 1978 49 p refs In ITALIAN
(FUB-22-1978) Avail: NTIS HC A03/MF A01

Some UHF experimental results and a mathematical model are described. The model is limited to the given experimental data and can not be used to predict the behavior of other systems. A deeper knowledge of the relationship of multipath fading to environmental conditions such as temperature, humidity, wind, refraction index, and their gradients is necessary. For a complete definition, a study of the effect environmental variables have on the received signal phase shift, on the cross-polarization, and on the type of modulation used is also required. Author (ESA)

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N79-28402 California Univ., Berkeley.
THE UNCLAMPED AND CURRENT CLAMPED SUPARAMP: STUDIES OF THE UNBIASED JOSEPHSON JUNCTION PARAMETRIC AMPLIFIER Ph.D. Thesis
Dorn William Peterson 1978 73 p
Avail: Univ. Microfilms Order No. 7914729

The operation of a Superconducting Unbiased PARametric AMPlifier (SUPARAMP), a parametric amplifier whose active element is a Josephson junction was anayzed under the assumption that the voltage across the junction has a nearly sinusoidal time dependence. In practice, Josephson junction amplifiers will often be operating in the opposite limit (where the current through the junction is sinusoidal)because of the generally low impedances of Josephson junctions. The analysis of this opposite limit was extended in order to obtain results for: (1) the characteristics of the external circuit necessary to obtain high gain, (2) the gain-bandwidth product, (3) powerwidth at a specific gain, and (4) the expected noise temperature of such an amplifier. Dissert. Abstr.

N79-28403 Rutgers - The State Univ., New Brunswick, N. J.
INVESTIGATIONS IN BASE METAL SYSTEMS AS POTENTIAL ELECTRODE MATERIALS FOR USE IN BARIUM TITANATE MONOLITHIC CAPACITORS Ph.D. Thesis
John D. Connolly, Jr. 1979 131 p
Avail: Univ. Microfilms Order No. 7916134

An attempt to devise a base metal electrode system which is matched to a specific commercially available dielectric is presented. Dissert. Abstr.

N79-28404 California Univ., Los Angeles.
A SENSITIVITY STUDY OF FILTER NETWORKS: DIGITAL AND ANALOG Ph.D. Thesis
Sung Moon Yang 1979 148 p
Avail: Univ. Microfilms Order No. 7915693

Digital filter structures are surveyed in a qualitative fashion. All essential features of the structures are discussed so that their advantages and disadvantages in the view of sensitivity are reasonably apparent. The sensitivity of wave digital filters is studied and in particular it is expressed in terms of those of their reference filters. From this relationship much of numerically observed properties of the sensitivity of wave digital filters are explained. As a byproduct its computation can be done by analyzing the reference filter. Statistical estimation of coefficient digit is discussed. Internal signal scaling within the filter is also discussed and a relation between sensitivity and roundoff noise is shown by expressing upper and lower bounds of roundoff noise in terms of sensitivities. Dissert. Abstr.

N79-28405 California Univ., Berkeley.
MOS SWITCHED-CAPACITOR ANALOG SAMPLED-DATA RECURSIVE FILTERS Ph.D. Thesis
Ian Alexander Young 1978 224 p
Avail: Univ. Microfilms Order No. 7914825

Whether analog sampled-data recursive filters can be fully integrated efficiently in MOS technology was investigated. A new technique for realizing precision audio frequency filters (lowpass, bandpass, or highpass) was developed. A fully integrated prototype was designed and fabricated using standard MOS technology. This high Q filter (Q=19) shows excellent control of its frequency response without need for component trimming. These filters occupy small silicon area, and are suitable for the multiplexing of two or more channels. Programmable filters and N-path filters can be realized with this technique. In this approach precision ratioed MOS capacitors and MOS operational amplifiers were used to realize direct from biquadratic sections. These can be configured to implement any type of sampled-data filter response. Dissert. Abstr.

N79-28406 Purdue Univ., Lafayette, Ind.
NOISE MEASUREMENTS IN ELECTRON-BEAM-EVAPORATED AMORPHOUS SILICON THIN FILMS Ph.D. Thesis
Michael H. Kriegel 1978 232 p
Avail: Univ. Microfilms Order No. 7914918

Electrical measurements, including current-voltage characteristics, dc and ac conductivities, and excess current noise spectral densities as a function of temperature were performed on a number of amorphous silicon films, as a means of probing the density-of-states (DOS) function in the mobility gap of this material. A significant result of this research was the first reported observation in amorphous silicon of a temperature

dependence of the exponent alpha in amorphous silicon as a function of the film temperature. Alpha varied from 1 to 2 and back to 1 as the film temperature was raised above room temperature. Alpha increased to 2 in the range of 150-200 C and at higher temperatures, alpha dropped back toward unity. This behavior was qualitatively interpreted as indicating the absence of a large peak in the DOS near epsilon sub F.
Dissert. Abstr.

N79-28407 California Univ., Berkeley.
HIGH PERFORMANCE PIEZOELECTRIC FIELD-EFFECT TRANSDUCERS AND THEIR APPLICATIONS Ph.D. Thesis
Sze-Hon Kwan 1978 314 p
Avail: Univ. Microfilms Order No. 7914666

The PI-DMOST and the piezoelectric thin film capacitor dual-gate D-MOST, two members of the PI-FET family, were investigated theoretically and experimentally. Both devices showed high performance, solid-state, strain microtransducers having applications in fields such as nondestructive testing and acoustic wave signal processing. An oriented piezoelectric ZnO thin-film is employed in both devices as the transducing medium. Strain sensitivity results from direct coupling of piezoelectrically induced charges to the channel of the D-MOSTs. Major advantages of these two device configurations over the transducers and previous PI-FETs are higher sensitivity, a wider range of operating frequency, faster response time, smaller and more well-defined sensing area, and compatibility with planar IC technology. Dissert. Abstr.

N79-28408 Carnegie-Mellon Univ., Pittsburgh, Pa.
MULTIPLE CRITERION OPTIMIZATION AND STATISTICAL DESIGN FOR ELECTRONIC CIRCUITS Ph.D. Thesis
Michael Roy Lightner 1979 206 p
Avail: Univ. Microfilms Order No. 7916179

The ideas and techniques of multiple criterion optimization (MCO) were reviewed. A family of weighted p norm methods for generating noninferior solutions to the multiple criterion optimization problem were developed. Using the p norm family the degree of a noninferior solution and a canonic weight was defined for each noninferior solution. The MCO solution techniques implemented using two different constrained optimization algorithms and are then compared on a test problem. Techniques of MCO and yield estimation were applied to the design of a two input gates. The results indicate the feasibility of adding yield as an objective to the MCO design problem and confirm the usefulness of the MCO viewpoint in the design of electronic circuits. Dissert. Abstr.

N79-28409 California Univ., Berkeley.
THE SIMULATION OF LARGE SCALE INTEGRATED CIRCUITS Ph.D. Thesis
Arthur Richard Newton 1978 234 p
Avail: Univ. Microfilms Order No. 7914715

The hybrid simulation program SPLICE, developed for the analysis and design of LSI (Large Scale Integrated) Metal-Oxide-Semiconductor (MOS) circuits is described. SPLICE allows the designer to choose the form of analysis best suited to each part of the circuit and logic, timing and circuit analyses are performed concurrently. The use of an event scheduling algorithm and selective-trace analysis allows the program to take advantage of the relatively low activity of LSI circuits to reduce the cost of the simulation. SPLICE is written in FORTRAN and is approximately 8000 statements long. The algorithms and data structures used in SPLICE are described and a number of example simulations are included. Dissert. Abstr.

N79-28410 Carnegie-Mellon Univ., Pittsburgh, Pa.
METAL CONTACTS ON GALLIUM ARSENIDE Ph.D. Thesis
Dale Lee Partin 1979 237 p
Avail: Univ. Microfilms Order No. 7911933

Many transition elements significantly change the hole diffusion length of vapor phase epitaxial (VPE) n-GaAs and n-GaAsP. Nickel diffuses rapidly into GaAs at 500 C and complexes with an electron trap with 0.83eV activation energy which commonly occurs in VPE and ingot GaAs. Cobalt degrades the hole diffusion length in GaAsP, and limited deep level transient spectroscopy studies suggest that the lifetime controlling Co level may be at about E sub v + 0.7eV. Tetrahedral, covalent radii of transition elements are related to their single acceptor energy levels and distribution coefficients. It is also found that metals with small radii tend to degrade the hole diffusion length in GaAs and GaAsP. Results of chemical etching experiments show that many etching solutions leave trace amounts of metallic impurities on the surface which can diffuse into the semiconductor at high temperature and affect the minority carrier diffusion length. Dissert. Abstr.

N79-28411 California Univ., Berkeley.
HIGH SPEED ANALOG-TO-DIGITAL CONVERSION IN INTEGRATED CIRCUITS Ph.D. Thesis
Stewart Sidney Taylor 1978 178 p
Avail: Univ. Microfilms Order No. 7914788

An analog to digital converter system is proposed which achieves state-of-the-art performance at only a fraction of the complexity of commercially available units. This system is realized with several standardized integrated circuit building blocks. One such block, a high-speed absolute value amplifier and voltage comparator, was designed and integrated. The principles of high speed A/D converters were unified so that several well-defined techniques can be identified, understood, and compared. This amplifier can find additional uses in folded A/D converters, envelope detectors, RMS converters, and signal processors.
Dissert. Abstr.

N79-28412 Texas Univ. at Arlington.
MAGNETOSTATIC WAVE TRANSDUCERS Ph.D. Thesis
Hung Jen Wu 1978 178 p
Avail: Univ. Microfilms Order No. 7915902

A technology for analog, real time microwave signal processing at GHz frequencies (1-18 GHz) is presented. It utilizes slow magnetostatic waves (MSW) propagating in magnetically biased yttrium iron garnet (YIG) films. The MSW transducer was designed to create efficient energy transduction between the electromagnetic input excitation and the excited MSW launched in the YIG film, and also to achieve controlled bandpass shaping by using multiple element transducer arrays. The first successful study and modeling of both MSSW and MSFVW transducers for multielement devices were presented as well as the first impedance characterization at the driving point for these same transducers. Dissert. Abstr.

N79-28413 California Univ., Berkeley.
FOUNDATIONS OF NONLINEAR NETWORK THEORY Ph.D. Thesis
John Lanier Wyatt, Jr. 1978 227 p
Avail: Univ. Microfilms Order No. 7914820

The role of certain basic thermodynamic considerations - power flow, passivity, and reciprocity - in nonlinear circuit theory are presented. Dissert. Abstr.

N79-28414 Carnegie-Mellon Univ., Pittsburgh, Pa.
A STUDY OF THE CONTACT RESISTANCE IN THE VIAS OF A METAL-INSULATOR-METAL SYSTEM AND ITS EFFECT ON THE BEHAVIOR OF INTEGRATED CIRCUITS Ph.D. Thesis
Joseph John Fatula, Jr. 1978 145 p
Avail: Univ. Microfilms Order No. 7916183

Fabrication methods developed, designed to mimic those of current integrated circuit production lines, led to mean values of via contact resitances of approximately 3 x to the 8th power ohm-square centimeters. These values are more than an order of magnitude less than previous published values for comparable dimensions. A model was developed which explains the experimental results. Assuming an ideal interface, that is, a via with a perfect metal/metal junction, a contact resistance in the range 1 to 50 x -10 to the 10th power ohm-square centimeters is predicted depending on the via geometry (rectangular or circular). Dissert. Abstr.

N79-28415* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SYSTEM FOR AUTOMATICALLY SWITCHING TRANSFORMER COUPLED LINES Patent
William S. Dwinell, inventor (to NASA) (Rockwell Intern., Downey, Calif.) Issued 17 Jul. 1979 5 p Filed 9 Mar. 1978 Supersedes N78-22298 (16 - 13, p 1694) Sponsored by NASA

(NASA-Case-MSC-16697-1; US-Patent-4,161,661; US-Patent-Appl-SN-885067; US-Patent-Class-307-119; US-Patent-Class-307-98; US-Patent-Class-361-170) Avail: US Patent and Trademark Office CSCL 09C

A system is presented for automatically controlling transformer coupled alternating current electric lines. The secondary winding of each transformer is provided with a center tap. A switching circuit is connected to the center taps of a pair of secondary windings and includes a switch controller. An impedance is connected between the center taps of the opposite pair of secondary windings. The switching circuit has continuity when the AC lines are continuous and discontinuity with any disconnect of the AC lines. Normally open switching means are provided in at least one AC line. The switch controller automatically opens the switching means when the AC lines become separated.

Official Gazette of the U.S. Patent and Trademark Office

N79-28416* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

MICROWAVE DICHROIC PLATE Patent

Thomas E. Wise, inventor (to NASA) (Bendix Field Eng. Corp., Columbia, Md.) Issued 3 Jul. 1979 8 p Filed 16 Feb. 1978 Supersedes N78-18313 (16 - 09, P 1149) Sponsored by NASA

(NASA-Case-GSC-12171-1; US-Patent-4,160,254; US-Patent-Appl-SN-878542; US-Patent-Class-343-909) Avail: US Patent and Trademark Office CSCL 20N

A dichroic plate for microwave energy includes an array of interlaced crossed slots or dipole elements. Each of the elements includes first and second crossed arms that are at approximately right angles to each other and aligned with X and Y axes. The elements are arranged so that the centers thereof are aligned parallel to the X and Y axes to form columns and rows, and the interlacing is such that a line between the centers of all adjacent elements has nonzero, differing components relative to the X and Y axes. In one embodiment, the spacing between adjacent arms of different, adjacent elements is the same along the X and Y axes, while in a second embodiment, the spacing between similarly directed arms of adjacent elements differs from the spacing between oppositely directed arms of adjacent elements.

Official Gazette of the U.S. Patent and Trademark Office

N79-28417 British Library Lending Div., Boston Spa (England).

THE GALVANIC DEPOSITION OF LOW-CARAT GOLD ALLOYS AND THEIR USE IN ELECTRONICS

W. Saxer May 1979 12 p refs Transl. into ENGLISH from Metalloberflaeche (West Germany), v. 32, no. 11, 1978 p 529-531

(BLL-RTS-11702) Avail: British Library Lending Div., Boston Spa, Engl.

The applications of low alloyed gold layers for decorative purposes and for high technical quality in electrical equipment are represented. M.M.M.

N79-28418*# Science Applications, Inc., Vienna, Va. Radiation and Electromagnetics Div.

FIRST PRINCIPLES NUMERICAL MODEL OF AVALANCHE-INDUCED ARC DISCHARGES IN ELECTRON-IRRADIATED DIELECTRICS Final Report, Jul. 1978 - Feb. 1979

B. L. Beers, V. W. Pine, H. C. Hwang, H. W. Bloomberg, D. L. Lin, M. J. Schmidt, and D. J. Strickland Mar. 1979 203 p refs

(Contract NAS3-21378)

(NASA-CR-159560; SAI-102-79-002) Avail: NTIS HC A10/MF A01 CSCL 09C

The model consists of four phases: single electron dynamics, single electron avalanche, negative streamer development, and tree formation. Numerical algorithms and computer code implementations are presented for the first three phases. An approach to developing a code description of fourth phase is discussed. Numerical results are presented for a crude material model of Teflon. Author

N79-28419*# ORI, Inc., Silver Spring, Md.

ADVANCED RISK ASSESSMENT OF THE EFFECTS OF GRAPHITE FIBERS ON ELECTRONIC AND ELECTRIC EQUIPMENT, PHASE 1 Final Report

Leon S. Pocinki, Lawrence D. Kaplan, Merrill E. Cornell, and Reynold Greenstone May 1979 217 p refs

(Contract NAS1-15379)

(NASA-CR-159027) Avail: NTIS HC A10/MF A01 CSCL 09C

A model was developed to generate quantitative estimates of the risk associated with the release of graphite fibers during fires involving commercial aircraft constructed with graphite fiber composite materials. The model was used to estimate the risk associated with accidents at several U.S. airports. These results were then combined to provide an estimate of the total risk to the nation. A.R.H.

N79-28420*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFICIENCY ENHANCEMENT OF DUAL-MODE TRAVELING WAVE TUBES AT SATURATION AND IN THE LINEAR RANGE BY USE OF SPENT-BEAM REFOCUSING AND MULTISTAGE DEPRESSED COLLECTORS

Peter Ramins and Thomas A. Fox Jul. 1979 26 p refs

(NASA-TP-1486, E-9912) Avail: NTIS HC A03/MF A01 CSCL 09C

An axisymmetric, multistage depressed collector of fixed geometric design was evaluated in conjunction with an octave-bandwidth, dual-mode TWT. The TWT was operated over a wide range of conditions to simulate different applications. The collector was operated in three-, four-, and five-stage configurations, and its performance was optimized (within the constraint of fixed geometric design) over the range of TWT operating conditions covered. For operation of the dual-mode TWT at and near saturation, the collectors increased the TWT overall efficiency by a factor of 2 1/2 to 3 1/2. Collector performance was relatively constant for both the high and low TWT modes and for operation of the TWT across an octave bandwidth. For operation of the TWT in the linear, low-distortion range, collector efficiencies of 90 percent and greater were obtained, leading to a five- to twelvefold increase in the TWT overall efficiency for the range of operating conditions covered and reasonably high (greater than 25 percent) overall efficiencies well below saturation.

Author

N79-28421# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

MICROWAVE OSCILLATOR WITH A DIRECTIONAL COUPLER [OSCILADOR DE MICROONDAS COM ACOPLADOR DIRECIONAL]

Marcus Antonius Andrade Siqueira Jan. 1979 117 p refs In PORTUGUESE; ENGLISH summary

(INPE-1413-NTE/143) Avail: NTIS HC A06/MF A01

A microwave oscillator using a directional coupler was investigated. The oscillator conditions were theoretically analyzed and the frequency of oscillation and its temperature stability was investigated. An experimental microwave oscillator was built in dielectric supported strip line and tested. R.E.S.

N79-28422*# Cleveland State Univ., Ohio. Coll. of Engineering.

ERROR ANALYSIS IN THE MEASUREMENT OF AVERAGE POWER WITH APPLICATION TO SWITCHING CONTROLLERS Final Technical Report, 1 Oct. 1978 - 1 Oct. 1979

James E. Maisel Aug. 1979 83 p refs

(Grant NsG-3222)

(NASA-CR-158847) Avail: NTIS HC A05/MF A01 CSCL 09C

The behavior of the power measurement error due to the frequency responses of first order transfer functions between the input sinusoidal voltage, input sinusoidal current and the signal multiplier was studied. It was concluded that this measurement error can be minimized if the frequency responses of the first order transfer functions are identical. M.M.M.

N79-28423*# Pennsylvania State Univ., University Park. Electrical Engineering Dept.

DIPOLE AND QUADRUPOLE SYNTHESIS OF ELECTRIC POTENTIAL FIELDS M.S. Thesis

David G. Tilley Jul. 1979 166 p refs

(Grant NsG-3166)

(NASA-CR-158850) Avail: NTIS HC A08/MF A01 CSCL 09C

A general technique for expanding an unkown potential field in terms of a linear summation of weighted dipole or quadrupole fields is described. Computational methods were developed for the iterative addition of dipole fields. Various solution potentials were compared inside the boundary with a more precise calculation of the potential to derive optimal schemes for locating the singularities of the dipole fields. Then, the problem of determining solutions to Laplace's equation on an unbounded domain as constrained by pertinent electron trajectory data was considered. R.E.S.

N79-28424# Lee (J. S.) Associates, Inc., Arlington, Va.
DETECTION PERFORMANCE OF AN FM CORRELATOR Technical Report, 1 Feb. 1978 - 31 Jan. 1979
J. S. Lee and L. E. Miller Mar. 1979 48 p refs
(Contract N00014-77-C-0056)
(AD-A067751; JTR-79-03) Avail: NTIS HC A03/MF A01 CSCL 09/1

Detection of a carrier frequency-modulated by a Gaussian random process is studied for a detector consisting of the filtered product of two FM limiter/discriminator outputs. Results show that high detection probabilities can be achieved for appropriate values of receiver parameters. Author (GRA)

N79-28425# Loyola Univ., New Orleans, La. Dept. of Physics.
EXPERIMENTAL STUDY OF THE CHARACTERISTICS OF PLANAR THIN-FILM SQUIDS
24 Nov. 1978 19 p refs
(Contract N00014-75-C-1099)
(AD-A067718) Avail: NTIS HC A02/MF A01 CSCL 09/3

Superconducting Quantum Interference Devices (SQUIDs) have been fabricated as part of a superconducting instrumentation program. Measurements of the characteristics of planar thin-film SQUIDs were made. Inductive coupling and direct coupling between the SQUID and the external electronics were demonstrated. In each case the response to an applied field and the signal-to-noise ratio was determined. Results from the two coupling methods are compared. Author (GRA)

N79-28426# Microwave Associates, Inc., Burlington, Mass.
K(A) BAND MICROWAVE INTEGRATED CIRCUIT SPDT SWITCH DEVELOPMENT Interim Report, 11 Sep. 1977 - 31 Dec. 1978
Charles Buntschun Jan. 1979 47 p refs
(Contract N00173-77-C-0246)
(AD-A067879) Avail: NTIS HC A03/MF A01 CSCL 09/1

The report describes the design and development of a Ka-band (26.5 - 40 GHz) microstrip microwave integrated circuit SPDT switch with driver. The report describes the plated heat sink PIN diodes and the waveguide to microstrip transitions used in the design. Final performance data are presented and discussed. Author (GRA)

N79-28427# Aerospace Corp., El Segundo, Calif. Ivan A. Getting Labs.
TRANSIENT RADIATION AND DOSE-ENHANCEMENT EFFECTS IN TRANSISTORS Interim Report
G. Marshall Molen, Melvin J. Bernstein, Kenneth W. Paschen, and Robert H. Vandre Aug. 1978 35 p refs
(Contract F04701-77-C-0078)
(AD-A067629; TR-0078(3950-04)-4; SAMSO-TR-78-108) Avail: NTIS HC A03/MF A01 CSCL 09/1

The response of bipolar transistors to ionizing radiation is considered for a relatively soft x-ray spectrum. A plasma-focus device was used to irradiate several silicon transistors under controlled conditions so that the relative contributions to the radiation response could be isolated. The photocurrent response resulting from direct photon interaction with the silicon chip was in excellent agreement with computations made on the basis of device geometry; however, contributions from packaging effects were found to be less predictable. The high Z package resulted in a nonuniform dose deposition in the device. The resultant dose enhancement is compared with integrated depth-dose profiles calculated with a Monte Carlo electron transport code. Author (GRA)

N79-28428# Westinghouse Defense and Electronic Systems Center, Baltimore, Md. Systems Development Div.
DEGRADATION ANALYSIS OF CCD/CID DEVICES Final Technical Report, Jan. 1977 - Jul. 1978
John W. Dzimianski and Gerald M. Borsuk Apr. 1979 133 p refs
(Contract F30602-77-C-0037)
(AD-A069167; RADC-TR-79-58; Rept-56646) Avail: NTIS HC A07/MF A01 CSCL 09/1

The growing use of Charge-Coupled Devices (CCD's) in systems for analog signal processing has generated a need to develop information on degradation mechanisms that affect CCD devices due to their structure and operation. An experimental study of factors which influence the degradation of parameters and performance of analog charge coupled devices using accelerated stress techniques is reported. Measured parameters included charge transfer efficiency, dark current density, full well capacity, dynamic range, and insertion loss. Test cells of a surface channel device and a buried channel device were temperature bias stressed for 1000 hours with parametric measurements taken at 0, 168, 500 and 1000 hours. Dynamic and dc stresses were applied to separate test cells at 125 C and 200 C. Electrical parameters of the devices were measured at room temperature with the precaution taken to cool the devices to room temperature before electrical stress was removed. The test results indicated that a basic trend towards increased dark current and decreased charge transfer efficiency in the p-surface channel CCD's can be attributed to an increase in interface state density. Also, dynamic stressing of the surface channel devices tends to degrade parameters faster than dc stresses. GRA

N79-28429# ITT Electron Tube Div., Easton, Pa.
LONG LIFE X-RAY TUBES FOR AN/TAQ-2 SYSTEM Final Report, 15 Apr. 1977 - 28 Apr. 1979
Charles L. Shackelford Apr. 1979 24 p
(Contract DAAB07-77-C-2657; DA Proj. 1L7-62705-AH-94)
(AD-A068110; DELET-77-2657-F) Avail: NTIS HC A02/MF A01 CSCL 09/1

A series of modifications has produced an x-ray tube for the AN/TAQ-2 system having at least six times the life of the tube in present use. This was achieved principally by modifying metallurgical properties of the tube anode. A tube using a single crystal tungsten anode was demonstrated to have more than ten times the life of the present tube. A proposed MIL specification was written for the long life tube. Author (GRA)

N79-28430# Varian Associates, Palo Alto, Calif. Microwave Tube Div.
HIGH POWER MILLIMETER WAVE AMPLIFIER Interim Report, 31 Mar. - 1 Nov. 1978
S. Heji, Howard Jory, A. Karp, R. Morwood, A. Nordquist, and R. Symons Griffiss AFB, N. Y. RADC Apr. 1979 70 p refs
(Contract F30602-78-C-0011; ARPA Order 3192)
(AD-A068915; RADC-TR-79-45; IR-2) Avail: NTIS HC A04/MF A01 CSCL 09/5

The objective of this program is to design a high power pulsed amplifier for millimeter wave operation. The development is limited to the consideration of gyrotron-type amplifiers which involve an interaction based on cyclotron resonance. The present program was preceded by a Phase I study effort which explored the feasibility of gyroklystron amplifiers with cyclotron harmonic operation. The first interim report for Phase II covered the completion of testing of the X-band gyroklystron built under the previous study program. This report describes results on the first TE11 mode gyro-TWT experiment which demonstrated some net gain. The gain figures were somewhat lower than expected due to large launching losses. At the end of this reporting period, the tube had been rebuilt with an increased length and was essentially ready for testing. GRA

N79-28431# Syracuse Univ., N. Y. Dept. of Electrical and Computer Engineering.
STOCHASTIC BEHAVIOR OF DIGITAL COMBINATIONAL CIRCUITS Interim Report
David K. Cheng and A. U. Shankar Apr. 1979 26 p refs
(Grant AF-AFOSR-2807-75; AF Proj. 2304)
(AD-A068754; TR-79-4; AFOSR-79-0537TR) Avail: NTIS HC A03/MF A01 CSCL 09/3

The stochastic behavior of digital combinational circuits is analyzed by the use of Walsh functions. An n-input Boolean function is represented as a Walsh series and the error caused by noise is measured in terms of a distance which is the fraction of the time that the system output due to noise-corrupted signal differs from that due to signal alone. It is shown that the error can be expressed as the sum of two parts: one part depends only on noise statistics, and both are discussed and typical examples are given. GRA

N79-28432# Naval Research Lab., Washington, D. C.
NRL-USRD SERIES F42 OMNIDIRECTIONAL TRANSDUCER STANDARDS Interim Report
L. E. Ivey 11 May 1979 14 p refs
(AD-A068805; NRL-MR-3969) Avail: NTIS HC A02/MF A01 CSCL 20/1

A series of omnidirectional reference transducers for the frequency ranges from 1 Hz to 200 kHz when used as a hydrophone and from 2 to 200 kHz when used as a projector has been developed by the Naval Research Laboratory's Underwater Sound Reference Detachment in Orlando, Florida. The sensitive elements are all piezoelectric lead zirconate - lead titanate PZT-4 hollow spheres encapsulated in polyurethane. GRA

N79-28433# Edgerton, Germeshausen and Grier, Inc., Salem, Mass. Electronic Components Div.
FORTY KILOVOLT MEGAWATT AVERAGE POWER THYRATRON (MAPS-40), ADDENDUM Final Report, 15 Sep. 1977 - 15 Aug. 1978
J. J. Hamilton and D. V. Turnquist Feb. 1979 33 p
(Contract DAAB07-76-C-1352; DA Proj. 1L7-62705-AH-94)
(AD-A068814; DELET-TR-76-1352-F2) Avail: NTIS HC A03/MF A01 CSCL 09/1

The purpose of this 12 month program was to fabricate eight prototype MAPS-40 thyratrons to the design specifications derived during the original phase of this contract and thereby: (1) Assess the reproducibility and operating consistency of the developed tube, and (2) Provide ERADCOM with a number of sample tubes for experimental purposes. Results confirm the satisfactory performance obtained with the early developmental samples. Consistency in electrical performance, indicative of reproducibility was observed. GRA

N79-28434# Institut de Recherche de l'Hydro-Quebec, Varennes (Canada).
RESEARCH TO DETERMINE THE ACCEPTABLE EMERGENCY OPERATING TEMPERATURES FOR EXTRUDED DIELECTRIC CABLES Final Report
Hugues St.Onge, R. Bartnikas, M. Braunovic, C. H. deTourreil, and M. Duval Nov. 1978 140 p refs
(EPRI Proj. 933-1)
(EPRI-EL-938) Avail: NTIS HC A07/MF A01

Satisfactory limits of operation at elevated temperatures of extruded materials and cable constructions were determined. The study of the temperature behavior of polymer materials used in conventional extruded cables was presented. The results are presented in a form that emphasizes differences and similarities between the behavior of XLPE and EPR materials at elevated temperatures. The use of those materials at elevated temperatures is discussed with regard to satisfactory cable operation under emergency conditions. DOE

N79-28435# General Electric Co., Pittsfield, Mass.
STUDY TO DETERMINE THE POTENTIAL USE OF SILICONE FLUIDS IN TRANSFORMERS
Nov. 1978 127 p refs
(Contract EX-76-C-01-2115)
(HCP/T-2115) Avail: NTIS HC A07/MF A01

The family of silicone fluids, were surveyed to determine which fluids could be used in place of conventional hydrocarbon transformer fluids, and to study the effect of molecular structure and composition on the dielectric properties. Forty-one fluids were surveyed. Very few of the silicone fluids have dielectric strengths equal to transformer mineral oil or askarels at room temperature, although they can be operated at higher temperature. Some silicones are used in special applications, such as railway and precipitator transformers, but wide applications are unlikely. The most attractive silicones (except for cost) are methyl decyl polysiloxane, methyldodecyl siloxane, and methyldecylmethylethyl copolymer. DOE

N79-28436# Sandia Labs., Albuquerque, N. Mex.
GOLD PLATING FOR HYBRID MICROCIRCUITS
J. W. Dini and H. R. Johnson Apr. 1978 48 p refs Presented at the Plating and Electron. Ind. Symp., San Francisco, 16 Jan. 1979
(Contract EY-76-C-04-0789)
(SAND-77-8047; Conf-790103-2) Avail: NTIS HC A03/MF A01

Electrochemical porosity tests and auger electron spectroscopy were used to evaluate three gold electroplating formulations (citrate, phosphonic acid, and phosphate) at varying current densities, deposition modes (ad, dc, and pulse), and thicknesses for eventual use on hybrid microcircuits. Electroplated films were shown to be less porous than evaporated or sputtered films by at least an order of magnitude. Plating current densities of 75.6 A/sq m produced deposits more porous than those obtained at 10.8 and 32.4 A/ sq m current or pulse plated deposits were typically less porous than ac deposits. Auger electron spectroscopy showed more chromium to be present on the surface of evaporated than on electoplated gold coated hybrid microcircuits after heating at 300 C for two hours. In the amount of chromium which diffused through the films, a comparison of the various methods of electrodeposition showed very little difference. DOE

N79-28437# Brookhaven National Lab., Upton, N. Y.
NEUTRON SCATTERING OBSERVATIONS ON THE MAGNETIC PHASES OF RAREEARTH TERNARY SUPERCONDUCTORS
D. E. Moncton 1979 15 p refs Presented at 24th Conf. on Magnetism and Magnetic Mater., Cleveland, 14 Nov. 1978 Prepared jointly with Bell Telephone Labs., Inc., Murray Hill, N. J.
(Contract EY-76-C-02-0016)
(BNL-25342; Conf-781114-9) Avail: NTIS HC A02/MF A01

A number of ternary compounds become superconducting even though they contain a chemically ordered sublattice of magnetic rare-earth ions. Studies of the physical properties of these materials revealed anomalies below T/sub c/ which were attributed to magnetic ordering transitions. Using neutron spectrometers, a group demonstrated that simple magnetic structures with long-range order do occur, and some of the magnetic structures of these superconductors were solved. Specifically, it was found that in DyMo6S8 and TbMo6S8 an antiferromagnetic structure coexists with superconductivity. In two other compounds, ErRh4B4 and HoMo6S8 it was found that the development of ferromagnetism is responsible for the quenching of superconductivity. DOE

N79-28438# California Univ., Livermore. Lawrence Livermore Lab.
MODEL FOR A LOW PRESSURE SPARK GAP
Edward P. Lee 12 Feb. 1979 10 p
(Contract W-7405-eng-48; ARPA Order 3718)
(UCID-18059) Avail: NTIS HC A02/MF A01

The space and time dependent generation of plasma in a low pressure spark gap was modeled with a two dimensional Boltzmann equation. DOE

N79-28439# Brookhaven National Lab., Upton, N. Y.
HIGH VOLTAGE INSULATION AND BUSHING DESIGN FOR FLEXIBLE SUPERCONDUCTING CABLES
A. J. McNerney 1979 19 p refs Presented at the EPRI Sem. on Solid Dielectric Mater. Appl. to the Elec. Power Ind., Monterey, Calif., 24-26 Jan. 1979
(Contract EY-76-C-02-0016)
(BNL-25351; Conf-790141-1) Avail: NTIS HC A02/MF A01

Design details are presented for the high voltage insulation and feedthrough bushing for a flexible, superconducting, helium-cooled, 138 kV power transmission cable. The cable when installed will have helium at 15 atmospheric pressure and 6 to 8 K temperature flowing in the hollow cable core. The insulation requirements were met by a dielectric lapped from laminated tapes made from commercially available oriented polyethylenes

and polypropylenes. Epoxy bushings were chosen for further development. DOE

N79-28440# General Electric Co., Schenectady, N. Y. Research and Development Center.
LIGHT-TRIGGERED THYRISTORS FOR ELECTRIC POWER SYSTEMS Final Report
V. A. K. Temple and A. P. Ferro Nov. 1978 178 p refs
(EPRI Proj. 669-1)
(EPRI-EL-932) Avail: NTIS HC A09/MF A01

A program to develop a method of triggering a 53mm, 2600-volts, 1,000-amp thyristor with a light source is described. Normally, these devices are electrically triggered, but the need for placing a large number of these units in series for high-voltage applications made electrical triggering, with its associated insulation problems, expensive and complex. A light-sensitive gating method was developed, with associated amplifying layers built integrally into the power thyristor. LEDs and LDs were used as the light source. Fiber optics provided the electrical isolation and transmitted the light directly into the thyristor package. Results were a turn-on capability to handle a voltage rate-of-change of 2000 volts per microsecond, with a light input to the thyristor gate of 30 nanojoules. A problem was encountered and investigated in high rates of current flow at the instant of light trigger. This resulted in excess temperature levels in localized spots where the current flow was initiated. Packaging and light source options are discussed. DOE

N79-28441# Market Facts, Inc., Washington, D. C.
HIGH-EFFICIENCY ELECTRIC MOTORS: FOCUS GROUP RESULTS
Aug. 1978 39 p
(Contract EV-78-C-01-6458)
(DOE/TIC-10005) Avail: NTIS HC A03/MF A01

The question of whether high-efficiency electric motors represent an appropriate energy conservation technology for DOE commercialization efforts is addressed and these issues are covered: (1) feasibility of the commercialization of high-efficiency motors; (2) extent and nature of the market of these motors; (3) barriers and opportunities identified as critical to the commercialization of these motors and the relative importance of each; and (4) what actions, if any, should the Federal government take to promote commercialization. DOE

N79-28442# Bendix Corp., Kansas City, Mo.
CONCEPTS AND PROCESSES FOR ALTERNATE SOLENOID COILS Final Report
H. F. Jordan Feb. 1979 24 p refs Revised
(Contract EY-76-C-04-0613)
(BDX-613-2103-Rev) Avail: NTIS HC A02/MF A01

A solenoid coil concept with fire environment potential was proposed, fabricated, and evaluated with favorable results. A polyphenylmethylsiloxane polymer was used as a high temperature insulation coating for the bobbin coil assembly. Alternate concepts utilizing foil conductors and additional insulating materials were examined for followon development potential. DOE

N79-28443# Research Inst. of National Defence, Stockholm (Sweden).
INVESTIGATION OF THE SHOCK WAVE SENSITIVITY OF COAXIAL CABLE IN WATER, 1975 [UNDERSOEKNING AV KOAXIALKABELS KAENSLIGHET FOER STOETVAAGOR I VATTEN 1975]
Paul Stroem Apr. 1978 12 p ref In SWEDISH
(FOA-C-20233-D4) Avail: NTIS HC A02/MF A01

A previously unused antimicrophonic cable was compared with two other known types of cable. The new cable satisfied the necessary requirements for a cable which is exposed to shock waves in water during its use. R.E.S.

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N79-28444 California Univ., Berkeley.
ANALYSIS OF ERROR IN MONTE CARLO TRANSPORT CALCULATIONS Ph.D. Thesis
Thomas Edward Booth 1978 115 p
Avail: Univ. Microfilms Order No. 7914546

The variances of four Monte Carlo techniques for obtaining the expected number of collisions a particle makes are predicted and compared with the sample variances obtained by Monte Carlo calculations using each of the four techniques. Dissert. Abstr.

N79-28445 Columbia Univ., New York.
FINITE ELEMENT METHOD IN TRANSIENT AEROELASTIC PROBLEMS Ph.D. Thesis
Hugh Clark Briggs 1979 107 p
Avail: Univ. Microfilms Order No. 7916388

An analysis of the interaction problems between an elastic structure and a moving fluid is presented. The principles of the method were formulated for the case of finite nonisothermal deformations of the structure and unsteady flow of a compressible, viscous, heat conducting fluid. Details of the method and numerical examples were worked out for the simpler, and yet practically important conditions of isothermal deformations of the structure and compressible, inviscid, isentropic flow of the fluid. The application of the method for the analysis of transient problems of gas dynamics in one and two dimensions was demonstrated as well as, transient motion of a membrane interacting with a two-dimensional gas flow, and the resulting perturbations in the gas itself. Dissert. Abstr.

N79-28446 Syracuse Univ., N. Y.
SIMULTANEOUS HEAT AND MASS TRANSFER IN THE FORMATION OF SOLID PARTICLES FROM DROPLETS CONTAINING SUSPENDED SOLIDS Ph.D. Thesis
Eric Heath Larson 1978 259 p
Avail: Univ. Microfilms Order No. 7914230

A series of mathematical models was developed to describe the dynamics of the process including the size and mass histories of the droplets, the internal temperature and concentration of suspended solids of the droplet as a function of time and position within the droplet, the onset of crust formation, the growth of the crust, heat and mass transfer within the crust, and give a criteria for the prediction of crust expansion and rupture. The primary conclusions reached in this work are: (1) The decrease in mass transfer from a droplet containing suspended solids is an important factor in spray drier behavior; (2) The physical behavior and modelling of systems containing suspended solids of a macromolecular nature is substantially different from a system containing low molecular weight dissolved solids. Dissert. Abstr.

N79-28447 Louisville Univ., Ky.
ANALYSIS OF NONDESTRUCTIVE PROPERTIES OF INJECTION MOLDED POLYCARBONATE: FLUID MECHANICS Ph.D. Thesis
David Anthony Richards 1978 268 p
Avail: Univ. Microfilms Order No. 7915899

The relationships between the nondestructive properties of density, refractive index, and birefringence and injection velocity are analyzed for injection molded, 63.5 mm square by 2.54 mm thick, polycarbonate plaques. The equations of motion are developed for various cases assuming isothermal conditions in the rectangular plaque and its fan gate. Emphasis is placed on the equation for the velocity of a Newtonian fluid in a rectangular duct since the polycarbonate viscosity is independent of shear rate. From this, equations for average velocity and shear rate (through plaque thickness) are derived. Dissert. Abstr.

N79-28448 North Carolina State Univ. at Raleigh.
A STUDY OF TRANSIENT FREE CONVECTION FROM

SUDDENLY HEATED HORIZONTAL WIRES AND CYLINDERS Ph.D. Thesis
Joseph Rogers Parsons, Jr. 1979 86 p
Avail: Univ. Microfilms Order No. 7915568

A study of the transient free convective heat transfer from horizontal wires and cylinders in air subjected to a step change in heat rate is presented. For the wire experiments, an unbalanced Wheatstone bridge is described which allows simultaneous observation of wire temperature and heat rate, under transient as well as steady-state conditions. An overshoot of the steady state is shown to occur in the transient decay of the Nusselt number, and the occurrence, magnitude, and duration of this phenomenon is shown to depend upon the Rayleigh number. Simple stability theory is shown to explain the delay in the convective process which is associated with the overshoot in heat transfer. This theory is extended to account for finite diameter, heat capacity, and thermal conductivity of the cylinder in predicting, the convection delay time. A second apparatus is described which was used to verify the extended theory. Dissert. Abstr.

N79-28449 North Carolina State Univ. at Raleigh.
SEMISIMILAR SOLUTIONS FOR UNSTEADY FREE CONVECTION Ph.D. Thesis
Timothy Brett Rhyne 1979 124 p
Avail: Univ. Microfilms Order No. 7915569

The concept of semisimilar solutions is applied to the unsteady laminar boundary layer equations for free convection about a semiinfinite vertical flat plate. By this analysis, the number of independent variables in the boundary layer equations is reduced from three to two, under certain restrictions on the wall temperature. A number of possible wall temperature variations are derived. The possible variations of the body force term for semi-similar solutions are also considered. A general class of body force variations is obtained and the equivalent body shape for a constant body force is derived. Unique scalings are formulated for the semisimilar equations that aid in the numerical solution and in the physical interpretation of the results. A standard implicit finite difference method of solution is applied to the scaled equations for all the possible wall temperature variation derived. Dissert. Abstr.

N79-28450 Washington State Univ., Pullman.
EFFECT OF PROTRUDING NORMAL DIVIDERS ON THE TURBULENT FLOW BETWEEN PLANE BOUNDARIES Ph.D. Thesis
Alfredo Nicolas BarrigaRibera 1979 237 p
Avail: Univ. Microfilms Order No. 7915120

The flow field between parallel plates produced by protruding dividers was evaluated through the predictive capabilities of the TEACH program. Such flow fields are common to wire-and-plate electrostatic precipitators. The TEACH program provides a reasonably good prediction of mean flow velocities but is inadequate for reliable pressure, turbulence energy and Reynolds stress predictions. The inadequacy of the numerical scheme is due to the assumption of isotropicity in the turbulence model. Dissert. Abstr.

N79-28451 Missouri Univ. - Columbia.
HETEROGENEOUS TURBULENT MIXING LAYER INVESTIGATIONS UTILIZING A 2-D 2-COLOR LASER DOPPLER ANEMOMETER AND CONCENTRATION PROBE Ph.D. Thesis
James Leslie Brown 1978 363 p
Avail: Univ. Microfilms Order No. 7915216

An investigation of the two stream turbulent mixing layer was conducted. Velocity measurements were accomplished for all cases considered. Molar concentration of freon-12 was measured using a hot-wire based aspirating probe. Flow visualization photographs were obtained through the injection of smoke into one or the other of the two streams. These flow visualization studies lend added support of and insight into the coherent structures governing the mixing layer. A flow pattern for these structures is evolved which explains considerable experimental observations. Conclusions as to the behavior of the turbulent mixing layer were made. Dissert. Abstr.

N79-28452 California Univ., Berkeley.
CONVECTIVE HEAT TRANSFER IN POROUS INSULATION Ph.D. Thesis
Patrick Joseph Burns 1978 139 p
Avail: Univ. Microfilms Order No. 7914557

Steady, two dimensional flows were examined for rectangular, cylindrical, and spherical geometries. The effects of the buoyant force, the drag force, the relative directional resistances to flow, the specific geometry, nonisothermal bounding surfaces, and the external transferal of heat are considered quantitatively. The sensible heat change of the fluid flowing from the inner environment through the insulation and into the outer environment is treated explicitly and also implicitly by allowing the pressure fields to balance. Attention was directed towards modeling building walls and thermal storage and flow systems of the spherical and the cylindrical configuration. Presented results include the variations of the ratio of the effective thermal conductivity to the stagnant thermal conductivity. The convective transfer of heat can be sufficiently suppressed so that the minimum in the overall heat transfer is actualized. Dissert. Abstr.

N79-28453 Ohio State Univ., Columbus.
EXPERIMENTAL INVESTIGATION OF ANGULAR CASCADE PERFORMANCE Ph.D. Thesis
Buryl L. McFadden, Jr. 1979 249 p
Avail: Univ. Microfilms Order No. 7916003

The analysis of radial equilibrium was experimentally verified for compressible flow through a stationary cascade, where radial equilibrium was defined as uniform axial mass flow. A specially designed annular flow test apparatus was constructred and its features are described in detail. The results of detailed flow field surveys using three different blade angle settings are summarized and were compared with both the free vortex and the Engelman analysis. In order to aid visualization of the real flow field as measured, various computerized graphical presentations of the data are shown. In addition, these survey results were compared with analytical predictions from both a two dimensional computer program and a three dimensional computer program. Dissert. Abstr.

N79-28454 Purdue Univ., Lafayette, Ind.
THEORETICAL AND EXPERIMENTAL STUDY OF THERMAL AND HYDRODYNAMIC CONDITIONS IN A SHALLOW WATER LAYER HEATED FROM BELOW BY SUBMERGED HORIZONTAL CYLINDERS Ph.D. Thesis
Mahmood A. Yaghoubi 1978 373 p
Avail: Univ. Microfilms Order No. 7914987

Free convection from a single and an array of submerged horizontal cylinders in a shallow fluid layer was studied both experimentally and theoretically. Vertical thermal structure in the fluid layer was determined experimentally. The specific nature of the flow recirculation effects is a function of fluid depth for both the single cylinder and the array of cylinders. Conditions in the array was characterized by strong plume interactions for large space ratios and by symmetrical flow regions for small space ratios. To describe heat transfer from the single cylinder, a parameter was introduced to account for the combined effects of the fluid depth and the free surface temperature. Attempts were made to correlate heat transfer measurements in terms of the Rayleigh number and this parameter. A computer model was developed for a region of symmetry which existed between cylinders of the array. Dissert. Abstr.

N79-28455 Purdue Univ., Lafayette, Ind.
DETERMINATION OF VOID FRACTIONS FOR IMPROVED BOILING HEAT TRANSFER EVALUATION IN ROTATING HEAT EXCHANGERS Ph.D. Thesis
Robert Dale White 1978 225 p
Avail: Univ. Microfilms Order No. 7914986

To alleviate the uncertainty in computing the heat transfer coefficient, a method of predicting the area wetted by the liquid is required. Since the wetted area can be determined from the void fraction, an understanding of the void fraction is necessary. For this reason mathematical and experimental analyses of the void fraction were initiated. The large centrifugal force associated with the rotational system allows steady one-dimensional, separated two-phase flow conservation equations to be accurately applied to the boiling process within rotating heat exchangers. The equations, initially in differential form, are integrated between the inlet and exit of the flow channel. This results in a set of

three coupled algebraic equations. To obtain closure, the void fraction and mass quality are defined as functions of pressure. These equations are numerically solved. Dissert. Abstr.

N79-28456*# Detroit Diesel Allison, Indianapolis, Ind.
LASER ANEMOMETER MEASUREMENTS AT THE EXIT OF A T63-C20 COMBUSTOR Final Report, Sep. 1978 - Apr. 1979
D. B. Zimmerman Apr. 1979 44 p refs Sponsored in part by Army Research and Develop. Command, Cleveland
(Contract NAS3-21267; DA Proj. 1L1-62209-AH-76)
(NASA-CR-159623; DDA-RN-79-4) Avail: NTIS HC A03/MF A01 CSCL 20D

An experimental study of the flow downstream of a T63-C20 gas turbine engine combustor was performed. Laser anemometer measurements of the mean and fluctuating velocities were made in a combustion rig across an annulus simulating the inlet to turbine. A window design suitable for similar measurements in a gas turbine engine was made based on the results of this experiment. Insufficient numbers of naturally-occurring scattering particles were present in the flow. Hollow phenolic particles added to the flow provided adequate signal strength for measurement. For each of the simulated engine operating conditions of flight idle, 30% power and 90% power, both with and without the addition of fuel, the mean velocities and turbulent intensities were uniform across the annulus. The turbulent intensity was substantially unaffected by the addition of fuel but was apparently only dependent on the inlet flow condition at a given power point. Little or no swirl was present in the flow at the annulus. Author

N79-28457*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PREDICTION OF EXPANSION-TUBE FLOW CONDITIONS USING A NONDIMENSIONAL VELOCITY NUMBER
N. M. Reddy Jun. 1979 37 p refs
(NASA-TM-80128) Avail: NTIS HC A03/MF A01 CSCL 20D

A simple analytical expression was derived which can be used to estimate the real gas performance of an expansion tube. This equation is called the expansion-tube equation analogous to the classical shock tube equation. This expansion-tube equation brings out clearly the various parametric dependencies of an expansion tube performance. Expansion tube performance obtained by using the present method was compared with the real-gas equilibrium expansion theory in the case of several test-gas/acceleration-gas combinations such as Air/Air, Argon/Argon, CO2/CO2 and Neon/Neon. Quantitative differences that exist between the above two methods were established. S.E.S.

N79-28458# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
STATISTICAL THEORY OF TURBULENCE
1970 193 p refs Lecture held at Rhode-Saint-Genese, Belgium, 12-16 Jan. 1970
(VKI-Lecture-Series-17) Avail: NTIS HC A09/MF A01

Statistical data was obtained to provide stable information on turbulence. The characterization of the structure of turbulence was described mathematically by using correlations. Equations were derived and numerical analysis was presented. For individual titles, see N79-28459 through N79-28469.

N79-28459# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
A REVIEW OF FLUID MECHANICS
David A. Lee *In its* Statistical Theory of Turbulence 1970 27 p (For primary document see N79-28458 19-34)
Avail: NTIS HC A09/MF A01

Integro-differential equations are derived in describing the behavior of Newtonian fluids. M.M.M.

N79-28460# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
BASIC CONCEPTS OF TURBULENT FLOW DESCRIPTIONS
David A. Lee *In its* Statistical Theory of Turbulence 1970 9 p (For primary document see N79-28458 19-34)
Avail: NTIS HC A09/MF A01

The concept of mean and random flows as well as the effects of fluctuations on the mean flow are discussed. The Boussinesq approach and mixing length theory was considered as a tool in describing turbulence. M.M.M.

N79-28461# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
SYMMETRY CONSIDERATIONS AND CLOSURE HYPOTHESES
David A. Lee *In its* Statistical Theory of Turbulence 1970 9 p (For primary document see N79-28458 19-34)
Avail: NTIS HC A09/MF A01

Symmetry conditions are found to determine the forms of the various correlator tensors which allow for consideration of sets of fewer independent and dependent variables when applied to turbulence. M.M.M.

N79-28462# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
AN INTRODUCTION TO THE CALCULUS OF FUNCTIONALS
David A. Lee *In its* Statistical Theory of Turbulence 1970 9 p (For primary document see N79-28458 19-34)
Avail: NTIS HC A09/MF A01

A numerical analysis of functionals is described and applied in the description of turbulent fluid motion. M.M.M.

N79-28463# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
FUNCTIONAL FORMULATIONS OF THE TURBULENCE PROBLEM
David A. Lee *In its* Statistical Theory of Turbulence 1970 10 p refs (For primary document see N79-28458 19-34)
Avail: NTIS HC A09/MF A01

The formulations of Hopf, Lewis and Kraichnan on the functional of a probability measure of function spaces are presented to determine fluid velocity fields in a given set of boundary conditions. M.M.M.

N79-28464# Liege Univ. (Belgium). Institut de Mathematique.
THE STATISTICAL THEORY OF HOMOGENEOUS TURBULENCE
Jacques C. J. Nihoul *In* Von Karman Inst. for Fluid Dyn. Statistical Theory of Turbulence 1970 24 p refs (For primary document see N79-28458 19-34)
Avail: NTIS HC A09/MF A01

The phenomenon of homogeneous turbulence presented, with boundary conditions, are specified by a statistical uniformity with respect to position. M.M.M.

N79-28465# Liege Univ. (Belgium). Institut de Mathematique.
APPLICATION OF THE KOLOMOGOROV THEORY TO ATMOSPHERIC AND OCEANIC TURBULENCE
Jacques C. J. Nihoul *In* Von Karman Inst. for Fluid Dyn. Statistical Theory of Turbulence 1970 14 p refs (For primary document see N79-28458 19-34)
Avail: NTIS HC A09/MF A01

A stratified fluid, such as the atmosphere or the ocean is assumed to obey the Boussinesq equations. These equations are derived from the Navier-Stokes, continuity and energy budget equations for a Newtonian fluid under the assumption that the variations of the density are negligible in the Navier-Stokes and continuity equations except in the expression of the pressure gradient and gravity force per unit mass. This assumption mainly amounts to assuming that the fluid is incompressible and adding a vertical force called buoyancy whose magnitude obeys a coupled partial differential equation derived from the energy and other thermodynamic equations applicable to the stratified fluid. Author

N79-28466# Liege Univ. (Belgium). Institut de Mathematique.
VARIATIONAL PRINCIPLES FOR THE STUDY OF INHOMOGENEOUS TURBULENCE
Jacques C. J. Nihoul *In* Von Karman Inst. for Fluid Dyn. Statistical Theory of Turbulence 1970 13 p refs (For primary document

see N79-28458 19-34)
Avail: NTIS HC A09/MF A01

Turbulent, incompressible, isothermal flow between two parallel plates is described. The principle of maximum dissipation rate and maximum stability are presented. S.E.S.

N79-28467# California Univ., Livermore. Lawrence Radiation Lab.
THE RELATIONSHIP BETWEEN A WIENER-HERMITE EXPANSION AND AN ENERGY CASCADE
Steven Crow and Gregory H. Canavan *In* Von Karman Inst. for Fluid Dyn. Statistical Theory of Turbulence 1970 45 p Sponsored by DOE (For primary document see N79-28458 19-34)
Avail: NTIS HC A09/MF A01

A theory of Burgers turbulence involving a truncated Wiener-Hermite expansion of the velocity field is described. Numerical analysis shows that the theory predicts an insufficient rate of energy decay for Reynolds numbers larger than two. It is shown that an energy cascade in wave number space corresponds to a cascade of energy up through successive terms of the Wiener-Hermite expansion. Results indicate that Gaussianity has no bearing on the rate of convergence of an expansion whose white noise function is associated with the initial state. S.E.S.

N79-28468# Air Force Weapons Lab., Kirtland AFB, N. Mex.
THE APPLICATION OF WIENER-HERMITE EXPANSIONS TO MODELS OF TURBULENCE
Gregory H. Canavan *In* Von Karman Inst. for Fluid Dyn. Statistical Theory of Turbulence 1970 28 p refs (For primary document see N79-28458 19-34)
Avail: NTIS HC A09/MF A01

A theory of turbulence in which the velocity fields are expanded in Hermite functionals of Gaussian white noise function is presented. A fixed base expansion which applies to Burgers' model and in approximate form to fluid turbulence is developed. A simple Lagrangian theory of turbulence based on an advected white noise function is described. S.E.S.

N79-28469# Air Force Weapons Lab., Kirtland AFB, N. Mex.
SOME PROPERTIES OF A LAGRANGIAN WIENER-HERMITE EXPANSION
Gregory H. Canavan *In* Von Karman Inst. for Fluid Dyn. Statistical Theory of Turbulence 1970 18 p refs Presented at the Boeing Sci. Res. Lab. Symp. on Turbulence, Seattle, 23-27 Jun. 1969 (For primary document see N79-28458 19-34)
Avail: NTIS HC A09/MF A01

The turbulent velocity expanded in Hermite functionals of a Gaussian white noise random function advected by the fluid was proposed. The mechanics of converting this proposition into a comutable model is described. The range of validity as an approximation for incompressible, homogeneous, and isotropic turbulence was examined. S.E.S.

N79-28470*# Grumman Aerospace Corp., Bethpage, N.Y.
CRYOGENIC THERMAL DIODE HEAT PIPES Final Report
J. Alario Feb. 1979 59 p refs
(Contract NAS2-7492)
(NASA-CR-152268) Avail: NTIS HC A04/MF A01 CSCL 20D

The development of spiral artery cryogenic thermal diode heat pipes was continued. Ethane was the working fluid and stainless steel the heat pipe material in all cases. The major tasks included: (1) building a liquid blockage (blocking orifice) thermal diode suitable for the HEPP space flight experiment; (2) building a liquid trap thermal diode engineering model; (3) retesting the original liquid blockage engineering model, and (4) investigating the startup dynamics of artery cryogenic thermal diodes. An experimental investigation was also conducted into the wetting characteristics of ethane/stainless steel systems using a specially constructed chamber that permitted in situ observations. G.Y.

N79-28471*# Colorado State Univ., Fort Collins. College of Engineering.
PARTICLE DYNAMICS ASSOCIATED WITH THE SPACE ENVIRONMENT
V. A. Sandborn Jul. 1979 30 p refs
(Contract NAS8-31688)
(NASA-CR-3158; M-285) Avail: NTIS HC A03/MF A01 CSCL 20D

A major factor in dust dynamics in a microgravity environment is the absence of settling; hence, Spacelab air will contain larger particles than a comparable laboratory on earth. In addition, the presence of low level acceleration fluctuations (thruster firings, crew motions, etc.) could inhibit dust removal by surface scavenging. Because of the presence of larger particles, aerosol dynamics at larger Reynolds numbers must be considered. An accurate drag coefficient for spherical particles was developed for the higher Reynolds number phenomena. A general graphic correlation for the drag coefficient as a function of Reynolds and Knudsen numbers was developed based on currently available drag data for spheres. The general equations that govern dust dynamics were reviewed. R.E.S.

N79-28472# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
COMPUTATIONAL FLUID DYNAMICS, VOLUME 1
1978 404 p refs Lecture held at Rhode-Saint-Genese, Belgium, 13-17 Mar. 1978 2 Vol.
(VKI-Lec-Ser-1978-4-Vol-1) Avail: NTIS HC A18/MF A01

A lecture series is presented devoted to recent advances in the theory and applications of numerical methods for solving complex problems in fluid mechanics. Particular emphasis is placed on mapping techniques for body-fitted coordinate systems and recent progress in panel methods. For individual titles, see N79-28473 through N79-28477.

N79-28473*# Mississippi State Univ., Mississippi State.
NUMERICAL SOLUTION OF FLOW PROBLEMS USING BODY-FITTED COORDINATE SYSTEMS
Joe F. Thompson *In* Von Karman Inst. for Fluid Dyn. Computational Fluid Dyn., Vol 1 1978 105 p refs (For primary document see N79-28472 19-34)
(Contract N00014-74-C-0373; Grants NGR-25-001-055; NSG-1242; AF-AFOSR-2922-76-; DAAG29-76-G-0144; NSF ENG-74-2134)
Avail: NTIS HC A18/MF A01 CSCL 20D

The technique of boundary-fitted coordinate systems is based on a method of automatic numerical generation of a general curvilinear coordinate system having a coordinate line coincident with each boundary of a general multi-connected region containing any number of arbitrarily shaped bodies. Once the curvilinear coordinate system is generated, any partial differential system of interest can be solved on this coordinate system by transforming the equations and solving the resulting system in finite difference approximation on the rectangular transformed plane. This method of automatic body-fitted curvilinear coordinate generation is used to construct finite-difference solutions of the full, time dependent Navier-Stokes equations for the unsteady viscous flow about arbitrary two-dimensional airfoils, or any other two-dimensional bodies. Finally, initial results for three-dimensional applications are also presented. Author (ESA)

N79-28474# Ruhr Univ., Bochum (West Germany). Inst. fuer Konstruktiven Ingenieurbau.
FINITE ELEMENT METHODS FOR INVISCID AND VISCOUS FLOW PROBLEMS
Guenter Schmid *In* Von Karman Inst. for Fluid Dyn. Computational Fluid Dyn., Vol. 1 1978 41 p refs (For primary document see N79-28472 19-34)
Avail: NTIS HC A18/MF A01

A survey of the basic features of the finite element method is made; their applications to fluid dynamics are discussed. Compressible flow is discussed for subsonic velocities only. Possible finite element procedures are considered for incompressible viscous flow. In the special case of creeping flow, alternative extremum principles are available, as in the case of potential flow, and simplify the derivation of finite elements. The various methods are listed together with their essential boundary conditions and their natural (weak) boundary conditions. Graphical examples are shown. Author (ESA)

N79-28475# British Aerospace Dynamics Group, Bristol (England). Military Aircraft Div.
THE PANEL METHOD FOR SUBSONIC AERODYNAMIC

FLOW: A SURVEY OF MATHEMATICAL FORMULATIONS AND NUMERICAL MODELS WITH AN OUTLINE OF THE NEW BRITISH AEROSPACE SCHEME

B. Hunt *In* Von Karman Inst. for Fluid Dyn. Computational Fluid Dyn., Vol. 1 1978 70 p refs (For primary document see N79-28472 19-34)
Avail: NTIS HC A18/MF A01

A comprehensive description of the mathematical foundation of panel methods is given. An explanation of the basic errors inherent in most schemes, but manifested most dramatically for first order schemes employing an internal vortex lattice, is offered. The observation of certain guidelines makes it possible for first order schemes to compare with the accuracy of higher order schemes. Present capabilities and current developments are discussed. Least squares minimisation of source/vortex pseudo error on wing-type components is presented as an appendix.
Author (ESA)

N79-28476# Stuttgart Univ. (West Germany). Inst. A fuer Mechanik.

RECENT DEVELOPMENTS IN THE NUMERICAL SOLUTION OF THE NAVIER-STOKES EQUATIONS AND HYDRODYNAMIC STABILITY PROBLEMS

H. Fasel *In* Von Karman Inst. for Fluid Dyn. Computational Fluid Dyn., Vol. 1 1978 20 p refs (For primary document see N79-28472 19-34)
Avail: NTIS HC A18/MF A01

Major developments that have contributed to the advancement of the finite difference method are reviewed. The discussion is limited to solutions of the Navier-Stokes equation for two-dimensional incompressible flow. As an example of the application of finite difference methods to complex flow problems, the investigation of hydrodynamic stability and laminar-turbulent transition based on complete Navier-Stokes equations is discussed in detail.
Author (ESA)

N79-28477# Institut de Recherche d'Informatique et d'Automatisme, Roquencourt (France).

APPLICATION OF A FINITE ELEMENT METHOD TO TRANSONIC FLOW PROBLEMS USING AN OPTIMAL CONTROL APPROACH

M. O. Bristeau *In* Von Karman Inst. for Fluid Dyn. Computational Fluid Dyn., Vol. 1 1978 50 p refs Sponsored by Direction des Rech. et Etudes Tech. (For primary document see N79-28472 19-34)
Avail: NTIS HC A18/MF A01

The least squares method is introduced as a general technique for solving nonlinear equations. The complexity of the geometries appearing in realistic applications of transonic equations entails the use of the finite element method as it is well suited to the discretization of these problems. The results obtained for nonlifting and lifting bodies show the validity of the method. Improvements are needed to reduce the computing time and some suggestions to this end are made.
Author (ESA)

N79-28478# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

COMPUTATIONAL FLUID DYNAMICS, VOLUME 2

1978 322 p refs Lectures held at Rhode-Saint-Genese, Belgium 13-17 Mar. 1978 2 Vol.
(VKI-Lec-Ser-1978-4-Vol-2) Avail: NTIS HC A14/MF A01

A lecture series is presented on recent advances in the theory and applications of numerical methods for solving complex problems in fluid dynamics. Particular emphasis is given to mapping techniques for body-fitted coordinate systems and the recent progress in panel methods. For individual titles, see N79-28479 through N79-28483.
Author (ESA)

N79-28479# Liege Univ. (Belgium). Dept. of Applied Aerodynamics.

TIME-DEPENDENT METHODS FOR MIXED AND HYBRID STEADY FLOWS

Jean-Andre Essers *In* Von Karman Inst. for Fluid Dyn. Computational Fluid Dyn., Vol. 2 1978 109 p refs (For primary document see N79-28478 19-34)
Avail: NTIS HC A14/MF A01

Classical methods for the computation of steady mixed and hybrid flow are reviewed. Very fast artificial time-dependent methods are described and their efficiency proved by various subsonic and transonic nozzle flow computations. Because of the conservative character of the discretizations used, they lead to correct shock captures. Because of their generality and their rapidity, these methods are very efficient for the computation of two and three-dimensional transonic flows around airfoils, wings, and cascades. It is planned to explore the potential and flexibility of the time-dependent methods by treating problems involving finite element discretizations of the space operators in order to treat complex geometries.
Author (ESA)

N79-28480# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorentwicklung.

FAST ELLIPTIC SOLVERS AND THEIR APPLICATION TO FLUID DYNAMICS PROBLEMS

U. Schumann *In* Von Karman Inst. for Fluid Dyn. Computational Fluid Dyn., Vol. 2 1978 34 p refs (For primary document see N79-28478 19-34)
Avail: NTIS HC A14/MF A01

The properties of fast elliptic solvers are summarized and examples of their application to fluid dynamics problems, particulary in irregular shaped regions, are given. The discussion is restricted to two-dimensional problems although a generalization to multidimensions is possible. Several programs were compared on an IBM 370/168 computer clearly showing a greater efficiency for the direct methods as compared to the iterative schemes (ADI and SOR). The capacitance matrix technique used to solve elliptic equations on irregular regions is described. As examples, a subroutine (AOBST) for the solution of Poisson's equation on a two-dimensional rectangle with obstacles and internal Dirichlet conditions as well as a test-program for potential flow is described.
Author (ESA)

N79-28481# British Aerospace Dynamics Group, Bristol (England).

MULTI-GRID SYSTEMS FOR THE RAPID INVERSION OF PARTIAL DIFFERENTIAL EQUATIONS

A. Roberts *In* Von Karman Inst. for Fluid Dyn. Computational Fluid Dyn., Vol. 2 1978 74 p refs (For primary document see N79-28478 19-34)
Avail: NTIS HC A14/MF A01

Multigrid techniques are examined as an alternative method for achieving rapid inversion of the transonic Euler equations expressed in three-dimensional curvilinear coordinates. The main line of development of numerical analysis. A multigrid method which mimics a Poisson solver and the Newtonian convergence of the skeleton grid for two-dimensional isentropic flow with fitted shocks using curviiinear coordinates are given as examples.
Author (ESA)

N79-28482# British Aerospace Dynamics Group, Bristol (England).

THE COMPUTATION OF VORTEX FLOWS BY PANEL METHODS

S. A. Jepps *In* Von Karman Inst. for Fluid Dyn. Computational Fluid Dyn., Vol. 2 1978 39 p refs Sponsored in part by Min. of Defence (For primary document see N79-28478 19-34)
Avail: NTIS HC A14/MF A01

Use of panel methods to calculate flows in which vorticity exists in the body of the fluid is discussed. Calculation of the vortex wake behind a lifting wing is described. The more difficult problem of computing free vortices which interact strongly with nearly solid surfaces is then considered. A hybrid technique combining a three-dimensional attached flow method with a slender body separated flow method is discussed using a delta wing as an example.
Author (ESA)

N79-28483# University of Eastern Illinois, Charleston.

NUMERICAL SOLUTION OF NONLINEAR IMPLICIT FINITE DIFFERENCE EQUATIONS OF FLOW PROBLEMS BY PERTURBED FUNCTIONAL ITERATIONS

S. K. Dey *In* Von Karman Inst. for Fluid Dyn. Computational Fluid Dyn., Vol. 2 1978 64 p refs (For primary document see N79-28478 19-34)
Avail: NTIS HC A04/MF A01

A functional iterative scheme, obtained by perturbing nonlinear Gauss-Seidel iterations, was developed to solve nonlinear equations. At each iteration Gauss-Seidel iterates were added

to predetermined perturbation parameters computed in terms of quantities known a priori. These parameters determine the mode of convergence of the algorithm. The scheme is computationally simple and has a quadratic rate of convergence. Applications made so far give encouraging results. Author (ESA)

N79-28484# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

TWO-PHASE FLOWS IN NUCLEAR REACTORS, VOLUME 1

1978 403 p refs Lecture held at Rhode-Saint-Genese, Belgium, 17-21 Apr. 1978 2 Vol.

(VKI-Lec-Ser-1978-5-Vol-1) Avail: NTIS HC A18/MF A01

The lecture series presents an up-to-date review of the numerous problems which arise in the field of two-phase flow associated with nuclear reactors and considers the different methods available for solving them. Both pressurized water and liquid metal fast breeder reactors are covered. Topics such as nucleation, flow modeling, pressure drops, and heat transfer associated with boiling and condensation are discussed. In each case the available prediction For individual titles, see N79-28485 through N79-28496.

N79-28485# Nuclear Regulatory Commission, Washington, D. C. Reactor Safety Research Div.

TWO-PHASE PROBLEMS IN PWR'S

Yih Yun Hsu *In* Von Karman Inst. for Fluid Dyn. Two-Phase Flows in Nucl. Reactors, Vol. 1 1978 15 p refs (For primary document see N79-28484 19-34)

Avail: NTIS HC A02/MF A01

The loss of coolant accident (LOCA), with special reference to two phase flow phenomena is examined. The light water power reactor LOCA stages, blowdown, emergency core cooling (ECC), refill, and reflood are described. The importance of LOCA as the design-base accident and the uncertainties involved in two phase flow measurements are stressed. The uncertainty not only affects the accuracy of prediction, but also reduces confidence in the ability to postulate and select models. Author (ESA)

N79-28486# Nuclear Regulatory Commission, Washington, D. C.

BOILING HEAT TRANSFER EQUATIONS

Yin Yun Hsu *In* Von Karman Inst. for Fluid Dyn. Two-Phase Flows in Nucl. Reactors, Vol. 1 1978 73 p refs (For primary document see N79-28484 19-34)

Avail: NTIS HC A18/MF A01

Heat transfer during the blowdown and reflood phases of a light water reactor loss of coolant accident is analyzed in order to recommend a set of heat transfer equations with their related switching logics for best estimate model codes. The range of conditions, sensitivities, correlations, and data bases are discussed. Some aspects of reflood where definite answers are not yet available are examined. The proposed package recommands methods for calculating necessary parameters, but they will have to be verified later by experimental results. Author (ESA)

N79-28487# Nuclear Regulatory Commission, Washington, D. C.

CONDENSATION HEAT TRANSFER

Yih Yun Hsu *In* Von Karman Inst. for Fluid Dyn. Two-Phase Flows in Nucl. Reactors, Vol. 1 1978 18 p refs (For primary document see N79-28484 19-34)

Avail: NTIS HC A18/MF A01

Condensation phenomema related to nuclear reactor safety issues are examined. The most common configurations found in loss of coolant accidents and emergency core cooling are presented along with the usual range of heat transfer conditions. Equations for various condensation phenomena are developed. It is shown that a great deal of fundamental work will be needed before reaching a high level of confidence. Author (ESA)

N79-28488# Nuclear Regulatory Commission, Washington, D. C.

CODES AND TWO-PHASE FLOW HEAT TRANSFER CALCULATIONS

Yih Yun Hsu *In* Von Karman Inst. for Fluid Dyn. Two-phase Flows in Nucl. Reactors, Vol. 1 1978 26 p refs (For primary document see N79-28484 19-34)

Avail: NTIS HC A18/MF A01

Loss of coolant accident (LOCA) codes which have been written for the specific purpose of predicting safety aspects of reactor behavior are reviewed. Physical modeling of the thermal-hydraulic process, approximation and uncertainties of codes, and code requirements for equation selections are discussed. Examples of codes for thermal hydraulic calculations are given. Author (ESA)

N79-28489# Commissariat a l'Energie Atomique, Grenoble (France). Service des Transferts Thermiques.

TWO-PHASE FLOW PROBLEMS IN LIQUID METAL FAST BREEDER REACTORS

Jean Costa *In* Von Karman Inst. for Fluid Dyn. Two-Phase Flows in Nucl. Reactors, Vol. 1 1978 45 p refs (For primary document see N79-28484 19-34)

Avail: NTIS HC A18/MF A01

Some two phase flow problems encountered in the design and safety analysis of liquid metal fast breeder reactors are described. The introduction discusses properties of molten sodium and the stages into which an accident is divided. The problem of boiling phenomena occuring during slow transients at moderate power, such as those occuring during a pump coastdown without scram, is considered as a hypothetical reference accident for Theuper-Phenix reactor and is presented in detail. Author (ESA)

N79-28490# Commissariat a l'Energie Atomique, Grenoble (France). Service des Transferts Thermiques.

TWO-PHASE FLOW PATTERNS

J. M. Delhaye *In* Von Karman Inst. for Fluid Dyn. Two-Phase Flows in Nucl. Reactors, Vol. 1 1978 55 p refs (For primary document see N79-28484 19-34)

Avail: NTIS HC A18/MF A01

A comprehensive description of two-phase flow, refered to reactor cooling applications, is presented. Parameters of two phase-pipe flow are described. Experimental determination of flow patterns and cocurrent flow in vertical and horizontal pipes are examined. The flow pattern in a rod bundle as well as flooding and flow reversal are discussed including experimental correlations and theoretical approaches. Author (ESA)

N79-28491# Commissariat a l'Energie Atomique, Grenoble (France). Service des Transferts Thermiques.

LOCAL INSTANTANEOUS EQUATIONS

J. M. Delhaye *In* Von Karman Inst. for Fluid Dyn. Two-Phase Flows in Nucl. Reactors, Vol. 1 1978 37 p refs (For primary document see N79-28484 19-34)

Avail: NTIS HC A18/MF A01

A summary of a local instantaneous equations approach to two phase flow is presented. Primary and secondary jump conditions in the interface are considered starting with the integral balance laws written for a fixed control volume containing both phases. These are transformed to obtain a sum of two volume integrals and a surface integral. The volume integrals lead to the local instantaneous partial differential equations valid in each phase whereas the surface integral furnishes the local instantaneous jump conditions valid on the interface only. The dynamics of vapor bubbles and the hydrodynamics of liquid films are developed as examples. Author (ESA)

N79-28492# Commissariat a l'Energie Atomique, Grenoble (France). Service des Transferts Thermiques.

INSTANTANEOUS SPACE-AVERAGED EQUATIONS

J. M. Delhaye *In* Von Karman Inst. for Fluid Dyn. Two-Phase Flows in Nucl. Reactors, Vol. 1 1978 21 p refs (For primary document see N79-28484 19-34)

Avail: NTIS HC A18/MF A01

Space-averaged equations for two phase flow are presented. The limiting forms of the Seiling and Gauss theorems for volume and for area are discussed. The instantaneous volume averaged equations are derived. Stratified flow in a horizontal channel is given as an example. Author (ESA)

N79-28493# Commissariat a l'Energie Atomique, Grenoble (France). Service des Transferts Thermiques.

LOCAL TIME-AVERAGED EQUATIONS

J. M. Delhaye *In* Von Karman Inst. for Fluid Dyn. Two-Phase Flows in Nucl. Reactors, Vol. 1 1978 15 p refs (For primary document see N79-28484 19-34)

Avail: NTIS HC A18/MF A01

Time-averaged local variables in two phase flow are used considering the interfaces as density discontinuity surfaces. Simpler calculations than with or methods result. Difficulties in choosing the optimum averaging time interval are discussed. After recalling the basic mathematical tools, a single time-averaging operator and a double time-averaging operator are defined. Author (ESA)

N79-28494# Commissariat a l'Energie Atomique, Grenoble (France). Service des Transferts Thermiques.

COMPOSITE-AVERAGED EQUATIONS

J. M. Delhaye *In* Von Karman Inst. for Fluid Dyn. Two-Phase Flows in Nucl. Reactors, Vol. 1 1978 11 p refs (For primary document see N79-28484 19-34)

Avail: NTIS HC A18/MF A01

Space-time or time-space averaged equations are developed because of their many applications in practical problems of two phase flow in channels. These composite-averaged equations can be obtained both ways and their equivalence is demonstrated. A relationship connecting the interfacial area to the speed of displacement of the interfaces is established. The local specific area is defined. The limiting form of the fundamental identity is derived. The resulting space-time or time-space equations are shown. Author (ESA)

N79-28495# Commissariat a l'Energie Atomique, Grenoble (France). Service des Transferts Thermiques.

TWO-PHASE FLOW MODELING

J. M. Delhaye *In* Von Karman Inst. for Fluid Dyn. Two-Phase Flows in Nucl. Reactors, Vol. 1 1978 27 p refs (For primary document see N79-28484 19-34)

Avail: NTIS HC A18/MF A01

The two fluid model must be consistent with the balance laws written for each phase and the interfaces and can be written using either time-averages or space-averages. In the second case only transient flow problems with a single space variable can be dealt with. A list of hypotheses commonly accepted in order to simplify the equations is given. The different forms of the six equation system are recalled with particular emphasis on the difference equations introduced by Boure (1975). These equations display the dynamic and thermodynamic non-equilibrium that is the slip velocity and the differences between the enthalpies of each phase and the corresponding saturation enthalpies.

Author (ESA)

N79-28496# Commissariat a l'Energie Atomique, Grenoble (France).

TWO-PHASE FLOW INSTRUMENTATION

J. M. Delhaye *In* Von Karman Inst. for Fluid Dyn. Two-Phase Flows in Nucl. Reactors, Vol. 1 1978 44 p refs (For primary document see N79-28484 19-34)

Avail: NTIS HC A18/MF A01

A review of two phase measurement techniques is presented. Principles and applications are examined for photon attennation techniques, electromagnetic flowmeters, turbine flowmeters, and variable pressure-drop meters. Sampling techniques and local techniques are discussed. Author (ESA)

N79-28497# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

TWO-PHASE FLOWS IN NUCLEAR REACTORS, VOLUME 2

1978 394 p refs Lecture held at Rhode-Saint-Genese, Belgium, 17-21 Apr., 1978 2 Vol.

(VKI-Lec-Ser-1978-5-Vol-2) Avail: NTIS HC A17/MF A01

The flow of boiling liquids in liquid cooled nuclear reactors is reviewed in a lecture series. Flow instabilities, propagation phenomena, nucleation, critical flow, friction factors, transitions, etc., are discussed. For individual titles, see N79-28498 through N79-28505.

N79-28498# Commissariat a l'Energie Atomique, Grenoble (France). Service des Transports Thermiques.

PRESSURE DROPS IN ROD BUNDLES

Dominique Grand *In* Von Karman Inst. for Fluid Dyn. Two-Phase Flows in Nucl. Reactors, Vol. 2 1978 31 p refs (For primary document see N79-28497 19-34)

Avail: NTIS HC A17/MF A01

Geometrical parameters defining a rod-bundle and a qualitative picture of boiling phenomena are first reviewed. Then single phase flow pressure drop in rod-bundles are discussed. The mixed flow model is reviewed, which is the simplest to use, inspite of being somewhat crude since it assumes homogeneity of the floW variables all over the cross-section of the bundle. Finally the momentum balance between two interconnected homogeneized regions is derived. This constitutes the basis of the subchannel analysis used in computer codes COBRA, HAMBO, and FLICA. Author (ESA)

N79-28499# Commissariat a l'Energie Atomique, Grenoble (France). Service des Transferts Thermiques.

TWO-PHASE FLOW CALCULATIONS IN LIQUID METAL FAST BREEDER REACTORS

Dominique Grand *In* Von Karman Inst. for Fluid Dyn. Two-Phase Flows in Nucl. Reactors, Vol. 2 1978 57 p refs (For primary document see N79-28497 19-34)

Avail: NTIS HC A17/MF A01

Some available models used to describe the phenomena exhibited during a nuclear accident scenario are reviewed. Main characteristics of the models used are studied for one-dimensional or multidimensional boiling in a fixed geometry, for one dimensional cladding melting and relocation, and for multidimensional motion of molten materials (fuel and cladding). Author (ESA)

N79-28500# California Univ., Berkeley. Dept. of Nuclear Engineering.

REGIME TRANSITIONS IN BOILING HEAT TRANSFER

G. Yadigaroglu *In* Von Karman Inst. for Fluid Dyn. Two-Phase Flows in Nucl. Reactors, Vol. 2 1978 61 p refs (For primary document see N79-28497 19-34)

Avail: NTIS HC A17/MF A01

In boiling heat transfer, several points of transition between heat transfer and hydrodynamic regimes are observed to occur. These include the incipience of boiling, net vapor generation, dryout, rewetting, and the transition from inverted-annular to dispersed-flow boiling. Physical understanding of the phenomena occuring during the transitions enumerated above is discussed with emphasis on applications to the analysis of steady-state and transient, normal as well as accident conditions in nuclear reactors. Successful models of the transitions and state-of-the-art correlations to predict these are presented. Author (ESA)

N79-28501# California Univ., Berkeley. Dept. of Nuclear Engineering.

TWO-PHASE FLOW INSTABILITIES AND PROPAGATION PHENOMENA

G. Yadigaroglu *In* Von Karman Inst. for Fluid Dyn. Two-Phase Flows in Nucl. Reactors, Vol. 2 1978 71 p refs (For primary document see N79-28497 19-34)

Avail: NTIS HC A17/MF A01

The potential for instabilities exists in all two-phase flow systems, including nuclear power systems. Two-phase flow instabilities are closely linked to propagation phenomena and kinematic waves. The nature and the characteristics of the various observed two-phase flow instabilities are reviewed with particular emphasis on pressure-drop excursions and oscillations, and density-wave oscillations. Experimental evidence and parametric trends are discussed and analyzed, and analytical methods available for predicting the occurence of instabilities are reviewed. Some current instability concerns in nuclear power systems are also discussed. Author (ESA)

N79-28502# Universite Catholique de Louvain (Belgium).

NUCLEATION

Michel Giot *In* Von Karman Inst. for Fluid Dyn. Two-Phase Flows in Nucl. Reactors, Vol. 2 1978 63 p refs (For primary document see N79-28497 19-34)

Avail: NTIS HC A17/MF A01

Nucleation phenomena are described. Mechanical concepts such as equilibrium of an interface and work of the capillary forces are reviewed. Thermodynamical equilibrium is examined using the Gibbs model. The influence of interfacial curvature on the equilibrium state, equilibrium of nucleus on solid surfaces, and homogeneus as well as heterogenous nucleation are discussed. Author (ESA)

N79-28503# Universite Catholique de Louvain (Belgium).
CRITICAL FLOWS
M. Giot *In* Von Karman Inst. for Fluid Dyn. Two-Phase Flows in Nucl. Reactors, Vol. 2 1978 69 p refs (For primary document see N79-28497 19-34)
Avail: NTIS HC A17/MF A01

The critical flow rate in two phase flow is discussed. The importance of this characteristic in the safety analysis of nuclear reactors is pointed out. The definitions of critical flow and sonic velocity are given. A review of experimental data is presented; main results and observations are reported. Several theoretical models from the literature are discussed. Author (ESA)

N79-28504# Universite Catholique de Louvain (Belgium).
FRICTION FACTORS IN SINGLE CHANNELS
M. Giot *In* Von Karman Inst. for Fluid Dyn. Two-Phase Flows in Nucl. Reactors, Vol. 2 1978 30 p refs (For primary document see N79-28497 19-34)
Avail: NTIS HC A17/MF A01

A survey of two phase flow friction factors determination is preceded by a theoretical analysis that includes the momentum balance and the homogeneous flow model. Experimental results from the literature are described and compared. Author (ESA)

N79-28505# Universite Catholique de Louvain (Belgium).
SINGULAR PRESSURE DROPS
M. Giot *In* Von Karman Inst. for Fluid Dyn. Two-Phase Flows in Nucl. Reactors, Vol. 2 1978 10 p refs (For primary document see N79-28497 19-34)
Avail: NTIS HC A17/MF A01

The two phase flow pressure drop in singularities such as sudden enlargement, sudden contraction, orifices, bends, and tees is analyzed. Theoretical formulas and empirical correlations are described. Author (ESA)

N79-28506# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
AERODYNAMIC SEPARATION OF GASES AND ISOTOPES: RECENT ADVANCES
1978 592 p refs Lecture held at Rhode-Saint-Genese, Belgium, 29 May - 2 Jun. 1978
(VKI-Lecture-Series-1978-8) Avail: NTIS HC A25/MF A01

A lecture series on aerodynamic methods which have been used to separate or have been proposed for separating uranium isotopes in UF6 is presented. For individual titles see N79-28507 through N79-28516.

N79-28507# Union Carbide Corp., Oak Ridge, Tenn. Nuclear Div.
STAGE SEPARATION THEORY
E. vonHalle *In* Von Karman Inst. for Fluid Dyn. Aerodyn. Separation of Gases and Isotopes: Recent Advan. 1978 123 p (For primary document see N79-28506 19-34)
(Contract W-7405-eng-26)
(K/OA-4247) Avail: NTIS HC A25/MF A01

The theory is developed starting with the stage separation factor definition, the value function, and the separative capacity of a separation stage. Tables of the value function are given. Rayleigh distillation and the separative work involved are described. Rayleigh distillation tables are included. The separative capacity of an element of column length in a continuous countercurrent column process and the reversible, isothermal work of separation are discussed. Cascade design is then discussed in detail, first developing the ideal cascade, and afterwards the squared-off cascade concepts. Finally the continuous separation process is explained. Several illustrative problems are presented. Author (ESA)

N79-28508# Union Carbide Corp., Oak Ridge, Tenn. Nuclear Div.
GASEOUS DIFFUSION
E. vonHalle *In* Von Karman Inst. for Fluid Dyn. Aerodyn. Separation of Gases and Isotopes: Recent Advan. 1978 40 p refs (For primary document see N79-28506 19-34)
(Contract W-7405-eng-26)
(K/OA-4245) Avail: NTIS HC A25/MF A01

The gaseous diffusion theory is explained. Some facts from history, plant capacities, and economic considerations are presented. The process is then described. Basic principles and cascade design are discussed, and then illustrated by actual industry examples. Author (ESA)

N79-28509# Centec G.m.b.H., Bergisch Gladbach (West Germany).
URANIUM ISOTOPE SEPARATION IN THE GAS CENTRIFUGE
Ernst Raetz *In* Von Karman Inst. for Fluid Dyn. Aerodyn. Separation of Gases and Isotopes: Recent Advan. 1978 10 p refs (For primary document see N79-28506 19-34)
Avail: NTIS HC A25/MF A01

An introduction to centrifuge technology is presented. Main emphasis is placed on the flow field, its various phenomena and the methods of calculation. Three chapters describe the basic principle of separation, some of the engineering principles of the centrifuge, and general features of the concentration distribution. Numerical solutions developed for this case are given in detail. Author (ESA)

N79-28510# Kernforschungszentrum, Karlsruhe (West Germany).
THE SEPARATION NOZZLE PROCESS
Wolf Ehrfeld *In* Von Karman Inst. for Fluid Dyn. Aerodyn. Separation of Gases and Isotopes: Recent Advan. 1978 45 p refs (For primary document see N79-28506 19-34)
Avail: NTIS HC A25/MF A01

An isotope separation technique is discussed. Basic principles are explained and the influence of several factors is analyzed. Experimental investigations of separation and flow phenomena are described, such as flow measurements by infrared laser absorption techniques, measurements with free molecular probes, and laboratory experiments with H2/UF6 mixtures. Commercial processing equipment and cascade design are illustrated. Author (ESA)

N79-28511# Kernforschungszentrum, Karlsruhe (West Germany).
SEPARATION NOZZLE SYSTEMS WITH DYNAMIC FLOW DEFLECTION
Ursula Ehrfeld *In* Von Karman Inst. for Fluid Dyn. Aerodyn. Separation of Gases and Isotopes: Recent Advan. 1978 28 p refs (For primary document see N79-28506 19-34)
Avail: NTIS HC A25/MF A01

The opposed jet separation nozzle and the annular separation nozzle were developed following the introduction of the commercial curved wall device. Avoiding fixed walls at the outer boundary of the centrifugal field reduces friction losses. The flow field was measured using the free molecular probe technique and the laser absorption technique. The concept of dynamic flow deflection seems to be a promising approach to the separation problem in light of the demonstrated reduction in the expansion ratio. Optimization studies and development work are still necessary if the full economic potential of this device is to be realized. Author (ESA)

N79-28512# Atomic Energy Commission Research Establishment, Riso (Denmark).
VORTEX TUBE FLOWS
C. U. Linderstroem-Lang *In* Von Karman Inst. for Fluid Dyn. Aerodyn. Separation of Gases and Isotopes: Recent Advan. 1978 44 p refs (For primary document see N79-28506 19-34)
Avail: NTIS HC A25/MF A01

Vortex tube configurations, flow distribution, separation capacity, practical results, and potential applications are discussed. The original Hilsch tubes and the temperature separation effect are explained. Analyzing Wikdhal's patent it is found that specific energy consumption is estimated to be 10 times too great for commercial application. The experiments carried out with 90 percent He carrier gas showed a 2 percent separation effect per tube. These results together with low cost mass production of tubes in matrix form may yet result in a feasible system. Author (ESA)

N79-28513# University of Southern California, Los Angeles. Dept. of Aerospace Engineering.
THE JET MEMBRANE AND SOME RELATED TOPICS
E. P. Muntz *In* Von Karman Inst. for Fluid Dyn. Aerodyn. Separation of Gases and Isotopes: Recent Advan. 1978 53 p refs (For primary document see N79-28506 19-34)

Avail: NTIS HC A25/MF A01

The jet membrane process is reviewed. Jet background interaction phenomena are analyzed, formulating an isotope separation theory. Experimental data supporting theoretical conclusions are presented. A simple theory is then used to establish an accurate model of jet background interaction. The degree of separation is adjustable and does not appear to have an upper bound. The apparatus is simple and lends itself easily to cascading. Economic analysis for a 3,000,000 g SWU/yr shows a capital requirement of 32 percent to 42 percent of that required by other processes while the total power cost is only 24 percent of that for the gaseous diffusion method. Author (ESA)

N79-28514# Commissariat a l'Energie Atomique, Seuran (France).

FLOW COOLING AS APPLIED TO LASER INDUCED SEPARATION

R. Campargue *In* Von Karman Inst. for Fluid Dyn. Aerodyn. Separation of Gases and Isotopes: Recent Advan. 1978 51 p refs (For primary document see N79-28506 19-34)
Avail: NTIS HC A25/MF A01

Flow cooling either in supersonic nozzles or free jets is described. Elimination of the hot bands of the infrared absorption spectra of UF6 is obtained and consequently selective excitation in laser separation is also achieved. It is shown that dilution in a monoatomic carrier gas results in low attainable temperatures. A He carrier free jet device, working in a zone of silence at rather high background pressures, is shown to have high development potential. Supersaturation and condensation phenomena are discussed. Author (ESA)

N79-28515# Sandia Labs., Albuquerque, N. Mex.

MODELING OF DISPARATE MASS MIXTURE FLOWS

R. R. Eaton, R. L. Fox, and K. J. Touryan *In* Von Karman Inst. for Fluid Dyn. Aerodyn. Separation of Gases and Isotopes: Recent Advan. 1978 77 p refs Sponsored by DOE (For primary document see N79-28506 19-34)
Avail: NTIS HC A25/MF A01

The behavior of transport equations for disparate mass fluids is examined. Ordering procedures applicable to the development of hydrodynamic equations are presented and methods of solutions are discussed. Monte Carlo procedures for disparate mass fluids are developed and applied to specific aerodynamic and hybrid aerodynamic schemes. Author (ESA)

N79-28516# Research Inst. of National Defence, Stockholm (Sweden).

PROLIFERATION PROBLEMS WITH URANIUM ENRICHMENT TECHNIQUES

Lars G. Stromberg *In* Von Karman Inst. for Fluid Dyn. Aerodyn. Separation of Gases and Isotopes: Recent Advan. 1978 3 p (For primary document see N79-28506 19-34)
Avail: NTIS HC A25/MF A01

Proliferation problems stemming from uranium isotope separation processes in connection with the production of nuclear devices are discussed. The observation is made that even a pilot plant can produce enough material for flow nuclear devices per year. Centrifuge techniques are thought to be more sensitive to proliferation because of a high separation factor combined with flexibility in cascade arrangement. Author (ESA)

N79-28517# ARO, Inc., Arnold Air Force Station, Tenn.

HEAT-TRANSFER, SURFACE-PRESSURE, AND BOUNDARY-LAYER SURVEYS ON CONIC AND BICONIC BODIES WITH BOUNDARY-LAYER TRIPS AT MACH NUMBER 6, PHASE 1 Final Report

Frederick K. Hube AEDC Aug. 1978 72 p refs
(AD-A067908; AEDC-TSR-78-V24) Avail: NTIS HC A04/MF A01 CSCL 20/4

Heat-transfer data were obtained on a 7-deg cone and a 14/7-deg biconic model to determine the minimum size distributed roughness required to bring boundary-layer transition near the model nose. Surface pressure and boundary-layer surveys were also obtained on a few configurations in an attempt to identify the difference in the characteristics of naturally turbulent boundary layers and those tripped with distributed roughness. Data were obtained at a nominal Mach number of 6 at Reynolds numbers ranging from 1,000,000 to 4,700,000 per foot. Most of the data were obtained at zero angle of attack although some data were obtained at angle of attack for a few selected bluntness/trip combinations. Author (GRA)

N79-28518# Pennsylvania State Univ., University Park. Applied Research Lab.

FOURTH-ORDER KELLER BOX SOLUTION OF THE INCOMPESSIBLE AXISYMMETRIC BOUNDARY LAYER EQUATIONS

J. M. Cimbala Feb. 1979 65 p refs
(Contract N00024-79-C-6043)
(AD-A067867; ARL/PSU-TM-79-18) Avail: NTIS HC A04/MF A01 CSCL 20/4

A computer code has been written for a general finite difference solution procedure of the incompressible boundary layer equations on a body of revolution. The procedure, a fourth-order accurate extension of Keller's Box Method, is capable of treating laminar or turbulent boundary layers up to a separation point and includes transverse curvature effects. The analysis has been coded for the Penn State IBM 370/3033 computer and has been shown to provide solutions comparable in accuracy to similar second-order schemes but with fewer grid points and with less computer time. Results and comparisons with both experiment and second-order methods are presented in graphical form for a low-drag body of revolution. Author (GRA)

N79-28519# Polytechnic Inst. of New York, Farmingdale. Dept. of Mechanical and Aerospace Engineering.

NAVIER-STOKES CALCULATIONS WITH A COUPLED STRONGLY IMPLICIT METHOD. PART 1: FINITE-DIFFERENCE SOLUTIONS Interim Report

Stanley G. Rubin and Prem K. Khosla Jan. 1979 14 p refs Presented at the 17th Aerospace Sci. Meeting, New Orleans, 15-17 Jan. 1979
(Contract F49620-78-C-0020; AF Proj. 2307)
(AD-A068768; POLY-M/AE-79-2-Pt-1; AFOSR-79-0626TR)
Avail: NTIS HC A02/MF A01 CSCL 20/4

Stone's unconditionally stable, strongly implicit numerical method is extended to the 2x2 coupled vorticity-stream function form of the Navier-Stokes equations. The solution algorithm allows for complete coupling of the boundary conditions. Solutions for arbitrary large time steps, and for cell Reynolds numbers much greater than two have been obtained. The method converges quite rapidly without adding artificial viscosity or the necessity for under relaxation. This technique is used here to solve for a variety of internal and external flow problems. Moderate to large Reynolds numbers are considered for both separated and unseparated flows. The procedure is extended to higher-order splines in Part 2 of this study. GRA

N79-28520# Battelle Pacific Northwest Labs., Richland, Wash.

SIZE DISTRIBUTION OF DROPS FROM CONTAINMENT SPRAY NOZZLES

T. B. Powers and D. L. Reid Jan. 1979 55 p refs
(Contract EY-76-C-06-1830)
(NUREG/CR-0608; PNL-2840) Avail: NTIS HC A04/MF A01

Typically PWR nuclear containment vessels are equipped with an array of spray nozzles that would be used to decontaminate the vessel atmosphere in the unlikely event of a loss-of-coolant accident. Since the decontamination rate is highly dependent upon the spray drop size, knowledge of the size distribution of the drops from a specified nozzle is required for mathematical prediction of washout rates for the radionuclides present in the vessel atmosphere. Spray washout rates for 1713A and 7G3 nozzles were empirically determined in the Containment System Experiments. DOE

N79-28521# California Univ., Livermore. Lawrence Livermore Lab.

DEVELOPMENT OF MECHANISTIC THEORY FOR DRYING OF POROUS MEDIA USING TWO-FLUID, TWO-PHASE FLOW THEORY

R. W. Lyczkowski 15 Mar. 1979 31 p refs Presented at 2d Multiphase Flow and Heat Transfer Symp. Workshop, Miami Beach, Fla., 16 Apr. 1979
(Contract W-7405-eng-48)
(UCRL-81604; Conf-790423-5) Avail: NTIS

HC A03/MF A01

A mechanistic phenomenological model for drying of porous media was established for a single representative pore by applying two-fluid, two-phase flow theory. The model rationally extends classical drying theory to handle rapid drying of moist solids where bulk motion of vapor and liquid water occurs within the drying matrix. The new model was developed to gain insight into the moisture dynamics of wet Western United States coals undergoing underground coal gasification. Simplifications were made to compare with other theories and models proposed or assumed in the literature to assess their correctness. Explicit expressions were also obtained for the evaporation rate and phase permeabilities. The extension to a global drying model was made. DOE

N79-28522# Sandia Labs., Livermore, Calif. Thermal Sciences Div.

GAS-TRANSFER ANALYSES, SECTION G: GAS FLOW IN REAL DUCT SYSTEMS

D. R. Chenoweth Mar. 1979 84 p refs

(Contract EY-76-C-04-0789)

(SAND-79-8212) Avail: NTIS HC A05/MF A01

A unified semi-empirical model was formulated to describe gas flow in an arbitrary series of independent ducting components which may include a y-joint. The model is valid generally until the possibility of local supersonic flow occurs, but it can be extended further under some circumstances. The gas is thermally and calorically perfect, and the duct flow is taken to be quasi-steady as well as one-dimensional near the stations where the conservation equations are evaluated. Each component is described by common empirical data consisting of total pressure loss, heat transfer, and flow contraction coefficients. Some sources of component total pressure loss coefficients are discussed. DOE

N79-28523# California Univ., Livermore. Lawrence Livermore Lab.

TACO: A FINITE ELEMENT HEAT TRANSFER CODE

W. E. Mason, Jr. Dec. 1978 75 p refs

(Contract W-7405-eng-48)

(UCID-17980) Avail: NTIS HC A04/MF A01

TACO can perform both linear and nonlinear analyses and can be used to solve either transient or steady state problems. Presently, TACO is specialized for two-dimensional problems of either plane or axisymmetric geometries. TACO has the capability to handle time or temperature dependent material properties and materials may be either isotropic or orthotropic. A variety of time and temperature dependent loadings and boundary conditions are available including temperture, flux, convection, and radiation boundary conditions and internal heat generation. Additionally, TACO has some specialized features such as internal boundary conditions (e.g., contact resistance), bulk nodes, enclosure radiation with view factor calculations, and chemical reactive kinetics. DOE

N79-28524# Tennessee Univ., Knoxville.

APPLICATION OF BASIC GAS RESEARCH TO PRACTICAL SYSTEMS

M. O. Pace, C. C. Chan, and L. G. Christophorou 1978 10 p refs Presented at IEEE Transmission and Distriubtion Meeting, Atlanta, Apr. 1979 Prepared jointly with ORNL

(Contract W-7405-eng-26)

(CONF-790417-3) Avail: NTIS HC A02/MF A01

Gaseous dielectrics are designed on the basis of knowledge of fundamental electron-molecule interactions. Breakdown measurements are reported for four binary mixtures of various proportions for the practical conditions of cylindrical geometry, surface roughness, contamination by free conducting particles, and electrode material composition. Each of these binary mixtures teams together one gas that primarily de-energizes free electrons and one gas that removes free electrons from the dielectric by electron attachment. Under all conditions the binary mixture containing SF6 were the worst of the four tested, and this is explained in terms of fundamental electron-molecule interaction processes. DOE

N79-28525# Iowa State Univ. of Science and Technology, Ames. Heat Transfer Lab.

HEAT TRANSFER TO LAMINAR IN-TUBE FLOW OF NON-NEWTONIAN FLUIDS. PART 1: ANALYTICAL STUDY

S. D. Joshi and A. E. Bergles Nov. 1978 187 p refs

(PB-292382/9; ISU-ERI-AMES-79088-Pt-1; HTL-17) Avail: NTIS HC A09/MF A01 CSCL 20D

The effects of nonNewtonian behavior and K-variation on heat transfer coefficients were studied. An explicit, stable numerical scheme, using the Dufort-Frankel finite difference method, was devised to solve the set of governing partial differential equations. In the constant property solutions, some increase in heat transfer coefficient above the Newtonian prediction is noticed. This increase is accounted for by employing a nonNewtonian correction for both entrance and fully developed regions. The variable property predictions were obtained for n = 0.75 and 0.5, and, for completeness, predictions were also obtained for the Newtonian case, n = 1.0. A two-step consistency correction was developed, one for the thermal entrance region and the other for the fully developed region. GRA

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N79-28526 Rochester Univ., N. Y.

PROCESSING STEREO PHOTOGRAPHS BY OPTICAL SUBTRACTION Ph.D. Thesis

Paul Walter Remijan 1979 150 p

Avail: Univ. Microfilms Order No. 7914499

The design of a fast, accurate, inexpensive and compact optical system for processing stereo transparencies is presented. Photographs of generated contour lines along with contour line irradiance profiles are presented to document performance of the new system. The capability of producing orthographic contour lines is demonstrated. Stereo photographs of geometrically regular objects are used in an image processing experiment where departures from theoretically perfect contour lines are related to the aberrations and fundamental limitations of the stereo photographic process. The new processing system is used to verify derived relationships between the stereo object, stereo photographic process and the form of output contour lines.

Dissert. Abstr.

N79-28527* National Aeronautics and Space Administration. Pasadena Office, Calif.

BIOCONTAMINATION AND PARTICULATE DETECTION SYSTEM Patent

Jacqueline M. Jacobs, inventor (to NASA) (JPL) Issued 10 Jul. 1979 6 p Filed 24 Feb. 1978 Supersedes N78-22587 (16 - 13, p 1734) Sponsored by NASA

(NASA-Case-NPO-13953-1; US-Patent-4,160,601;

US-Patent-Appl-SN-880727; US-Patent-Class-356-404;

US-Patent-Class-356-237) Avail: US Patent and Trademark Office CSCL 14E

A method for determining the characteristics and amount of microscopic contaminants lodged on a photographed surface is disclosed. An image enhanced full color photographic negative and print are taken of the contaminated surface. Three black and white prints are developed subsequently from red, green and blue separation filter overlays of the color negative. Both the color and three monochromatic prints are then scanned to extract in digital form a profile of any contaminant possibly existing on the surface. The resulting profiles are electronically analyzed and compared with data already stored relating to known contaminants.

Official Gazette of the U.S. Patent and Trademark Office

N79-28528# State Univ. of New York at Binghamton.

TEXTURE-TONE FEATURE EXTRACTION AND ANALYSIS, PHASE 2 Final Technical Report, 1 Jun. 1977 - 30 Sep. 1978

Shin-yi Hsu and Eugene Klimko Griffiss AFB, N. Y. RADC Mar. 1979 63 p refs
(Contract F30602-76-C-0211; AF Proj. 6244)
(AD-A068817; RADC-TR-79-37) Avail: NTIS HC A04/MF A01 CSCL 09/2

Since more than 50% of the 17 texture feature variables developed in the Phase I effort are not normally distributed, a non-linear classified based on stable distribution model was developed to accommodate the skewness characteristics of the texture data and thus improve the hit-rate of the decision maps of the test sets. With this classifier the needed texture feature variables were reduced to 3 from the original 17, resulting in a drastic improvement in the processing rate, i.e., a factor of 6 (times faster) has been achieved (from 90 minutes CPU to 15 minutes CPU with IBM 370-158 system). Currently the processing rate for (256 x 256) pixels with the ITEL AS-6 system is less than 4 minutes with FORTRAN programming language. The new classifier was able to improve the hit-rate by about 5 percentage points with an average hit-rate of 90% or higher. In addition, the amount of rejects was also reduced. With a manual method of the selection of training sets, the amount of rejects remains high even though a better classifier was used in the analysis. To solve this problem an automatic selection of training sets technique was developed with the intention that the rejects be included in the clusterings derived from randomly selected pixels from the test sets. With this method, the amount of rejects has been reduced to 3% or less from 20. GRA

N79-28529# Hughes Aircraft Co., Culver City, Calif. Aerospace Group.
HOLOGRAPHIC GRATING STUDY, VOLUME 1 Interim Report, Aug. 1976 - Feb. 1978
John O. Garvey, R. J. Withrington, O. G. Ramer, A. Au Livanos, A. C. Livanos, M. Minden, and G. M. Janney Griffiss AFB, N. Y. RADC Mar. 1979 224 p refs
(Contract F30602-76-C-0402; ARPA Order 1279)
(AD-A068811; HAC-DR-105-Vol-1; RADC-TR-78-279-Vol-1)
Avail: NTIS HC A10/MF A01 CSCL 20/6

The two primary goals of the study were to demonstrate the feasibility of fabricating low and high-efficiency ion-machined holographic gratings and, by means of optical analysis, to establish their suitability for use in practical high-energy laser systems. Both of these goals were achieved. The principal results of the study are summarized below: fabrication techniques for both low-efficiency and high-efficiency nonlinear holographic gratings were successfully demonstrated; the feasibility of producing high-efficiency holographic gratings, with respect to both design and fabrication, was established; the feasibility of designing aberration-corrected holographic gratings was demonstrated; several important optical configurations utilizing holographic gratings were analyzed in terms of their aberrations, as a function of various distortions and component tolerances; and two major HEL system applications of holographic gratings were investigated in depth: (a) a primary mirror holographic grating beam sampler for LOS or wavefront control; and (b) a holographic grating axicon for use as a mode-control device in an annular resonator. Author (GRA)

36 LASERS AND MASERS

Includes parametric amplifiers.

N79-28530 California Univ., Berkeley.
GaAs DOUBLE-HETEROSTRUCTURE INJECTION LASERS WITH LATERAL OPTICAL AND CURRENT CONFINEMENT Ph.D. Thesis
Luis Figueroa 1978 283 p
Avail: Univ. Microfilms Order No. 7914595

The optical and electrical characteristics of GaAs double-heterostructure injection lasers with lateral optical and current confinement are presented. Dissert. Abstr.

N79-28531 California Univ., Berkeley.
PICOSECOND PULSES FROM ULTRASHORT-CAVITY DYE LASERS Ph.D. Thesis
Bunsen Fan 1978 71 p
Avail: Univ. Microfilms Order No. 7914591

A method of generating tunable, narrow-band, highpeak-power, picosecond dye laser pulses is presented. The dye lasers have an ultrashort cavity with a length in the range of microns, and are pumped by picosecond optical pulses. Because of fast population inversion in the amplifying medium and short photon lifetime of the laser cavity, resonator transients are of picoseconds in duration. Salient features of ultrashort-cavity dye lasers are examined. Laser kinetics are studies analytically using a nonideal four-level model. Emission characteristics of experimental rhodamine B lasers with an ultrashort cavity are presented. Design, construction, and operation of a passively mode-locked Nd:glass laser, which is used as a pump laser, are discussed. Dissert. Abstr.

N79-28532*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DIRECTION SENSITIVE LASER VELOCIMETER Patent Application
John M. Franke, inventor (to NASA) Filed 6 Apr. 1979 11 p
(NASA-Case-LAR-12177-1; US-Patent-Appl-SN-027558) Avail: NTIS HC A02/MF A01 CSCL 20E

A laser velocimeter that determines the direction of movement of particles is described. A laser produces a transmitted beam which illuminates the volume under investigation. The backscattered light is divided into two equal intensity beams. A first part of a sample of the transmitted beam is mixed with one of the two equal intensity beams and applied to a first photodetector. A second part of the sample is phase shifted by 90 deg, mixed with the other of the two equal intensity beams and applied to a second photodetector. The output of the first photodetector is phase shifted by -90 deg and then multiplied with the output of the second photodetector to produce a signal indicative of direction of movement. NASA

N79-28533*# Florida Univ., Gainesville. Dept. of Nuclear Engineering Sciences.
BASIC RESEARCH RELEVANT TO CW-NUCLEAR PUMPED LASERS Final Report
Richard T. Schneider Jun. 1979 135 p refs
(Grants NGL-10-005-089; NsG-7299)
(NASA-CR-158837) Avail: NTIS HC A07/MF A01 CSCL 20E

Published and unpublished material representing the basic research conducted in connection with gaseous core reactors and nuclear pumped lasers is presented. R.E.S.

N79-28534# Owens-Illinois, Inc., Toledo, Ohio. Corporate Technology Div.
GENERATION OF COPPER FILMS ON LOW-EXPANSION SUBSTRATES FOR USE AS LASER MIRRORS Final Report, Jun. 1976 - Mar. 1977
P. P. Pirooz and G. Dube Oct. 1978 47 p
(Contract F33615-76-C-5343; AF Proj. 3216)
(AD-A067548; AFML-TR-78-139) Avail: NTIS HC A03/MF A01 CSCL 20/5

This report deals with the feasibility of producing superior mirrors for IR laser devices by utilizing copper-coated low-expansion glass-ceramic materials. These materials are produced by a unique self-generating process. Glass-ceramics developed and evaluated in this study have exhibited highly encouraging mirror characteristics such as good film-to-substrate adhesion, high specular reflectance at ten and six-tenths micrometers and high laser damage threshold at ten and six-tenths micrometers. A total of fifty-one samples was prepared and evaluated for the critical substrate and copper film properties. A total of five copper-coated samples was prepared for submittal to AFML for further evaluation. Author (GRA)

N79-28535# Massachusetts Inst. of Tech., Cambridge. Gas Turbine and Plasma Dynamics Lab.
FUNDAMENTAL MECHANISMS OF NONEQUILIBRIUM MHD LASING PHENOMENA Final Report, 1 Mar. 1977 - 28 Feb. 1978
Jack L. Kerrebrock Dec. 1978 397 p refs
(Contract F44620-76-C-0067)
(AD-A068190; AFOSR-79-0506TR) Avail: NTIS

HC A17/MF A01 CSCL 20/5

A feasibility study of MHD lasers has been carried out, consisting of a comprehensive numerical modeling and an experimental study of the gain of MHD generator behavior with a three-level model for the CO2 module which recognizes the lower level energy transfer by CO2 - CO2 collisions as the major limiting process. It predicts specific powers as high as 60 ki/kg at efficiencies near 3%. The experimental study has identified He + 0.014 CO2 + .00001 Cs as the optimum plasma mixture, and verified that a 0.3%/cm gain can be attained at a current density of 0.3 amp/sq cm and an electric field of 20V/cm. It has yielded a rate of (3.3 + or - 0.03) x 10 to the 7th power for the lower level deactivation. GRA

N79-28536# Alabama Univ. in Huntsville. School of Science and Engineering.

INVESTIGATION OF TRANSIENT FLOW AND HEATING PROBLEMS CHARACTERISTIC OF HIGH ENERGY LASER GAS CIRCULATION SYSTEMS Final Technical Report, 8 Aug. 1977 - 31 Mar. 1979

Cornelius C. Shih, Gerald R. Karr, and James F. Perkins Mar. 1979 309 p refs

(Contract DAAK40-77-C-0161)

(AD-A068547; UAH-RR-219; DRCPM-HEL-CR-79-8) Avail: NTIS HC A14/MF A01 CSCL 20/5

Complementing the Army effort on the Closed Cycle Circulator for repetitively pulsed electric discharge lasers, a project was conducted to develop computer programs modeling the recirculating gas flows in pulsed laser operation including steady and unsteady cases; to perform theoretical analysis of the unstable resonator with tilted spherical mirrors; to conduct an experimental investigation of transient fluid and thermal characteristics of the recirculating flow associated with the pulsed laser operation using a subscale circulator; and to experimentally determine the effects of mufflers, screen packs, and honeycombs on acoustic and thermal waves propagated in the recirculating flow. GRA

N79-28537# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INVESTIGATIONS OF NON-LINEAR PHENOMENA IN SOLUTIONS OF ORGANIC DYES AND THE CREATION OF HIGH-EFFICIENCY LASERS WITH FREQUENCY TUNING BASED ON THEM

M. T. Shpak and Ye. O. Tikhonov 21 Mar. 1978 20 p refs Transl. into ENGLISH from Visn. Akad. Nauk Ukr. RSR (USSR), no. 11, 1971 p 9-18

(AD-A068559; FTD-ID(RS)T-0258-78) Avail: NTIS HC A02/MF A01 CSCL 20/5

The principle characteristics of lasers in which molecular solutions of organic dyes are used as the active medium are discussed. Both the processes that occur in complex organic molecules under the influence of an intensive stream of coherent, monochromatic light and the development of a highly efficient active medium needed for lasers with frequency tuning are examined, with exphasis on foreign research. A.R.H.

N79-28538# Avco-Everett Research Lab., Mass.

ONE METER KrF LASER SYSTEM Semiannual Report, 24 Nov. 1977 - 24 May 1978

J. A. Mangano, J. C. Hsia, J. H. Jacob, M. Rokni, and C. Duzy 24 May 1978 83 p refs

(Contract N00014-76-C-1032; DARPA Order 3125)

(AD-A069053) Avail: NTIS HC A05/MF A01 CSCL 20/5

This interim technical report covers DARPA-sponsored research directed towards high power rare gas-halide lasers. The key issues being addressed are: kinetics leading to laser medium gain and absorption, laser energy extraction, upper and lower laser state kinetics, intrinsic laser efficiency, specfic energy, and energy scaling. By operating at elevated temperatures and e-beam pumped XeF laser intrinsic efficiency of 5.5% was obtained at a specific pulse energy of 5 J/1. The increase in efficiency is attributed to improved energy extraction from the XeF^* (B) vibrational manifold and to decreased lifetime of the XeF ground state. Detailed comparisons were made between KrF laser experiments and model calculations. Excellent agreement was obtained. The comparison also suggests the importance of KrF^* vibrational rotational relaxation and B and C state mixing on laser performance at pump intensities exceeding 1,000,000 W/cu cm. The rate constants for the reactions XeF (v) + Ne yields XeF (v prime) + Ne yields Xe + F + Ne and KrF + 2Kr(Ar) yields Kr2F ($ArKrF^*$) + Kr(Ar) have been calculated theoretically. GRA

N79-28539# TRW, Inc., Philadelphia, Pa.

SHARED APERTURE BREADBOARD TEST SYSTEM (SABTS) LASER SUPPORT Final Report

T. V. Roszhart, W. P. Ball, J. T. Sings, and J. L. Schmidt Dec. 1978 184 p refs

(Contract F29601-77-C-0010)

(AD-A068495; AD-E200265; AFWL-TR-77-135) Avail: NTIS HC A09/MF A01 CSCL 21/5

Deuterium Fluoride (DF) High Energy Laser (HEL) support was provided for testing aperture sharing optical elements in the HEL beam using the Shared Aperture Breadboard Test System (SABTS). The TRW Baseline Demonstration Laser (BDL) HEL facility was modified for SABTS, and laser support was provided for survivability tests of coatings and performance tests of dichroic beam splitters. As an add-on experiment, HEL survivability and performance tests of microwave windows and missile guidance heads were also supported. Author GRA

N79-28540# Sandia Labs., Albuquerque, N. Mex.

LASER DEVELOPMENT FOR LASER FUSION APPLICATIONS Progress Report, Apr. - Sep. 1978

Dec. 1978 77 p refs

(Contract EY-76-C-04-0789)

(SAND-78-2306) Avail: NTIS HC A05/MF A01

Three high power laser systems were discussed: iodine, HF, and GROUP IV atoms. Both the iodine lasers and the HF laser possess high power capability and show promise in the laser fusion applications. The technical progress of these programs was pointed out. DOE

N79-28541# Hughes Research Labs., Malibu, Calif.

RESEARCH ON FREQUENCY SHIFTING OF ULTRAVIOLET LASERS Final Report, 23 Jun. 1977 - 23 May 1978

M. B. Klein Jan. 1979 40 p refs

(Contract EN-77-C-04-3997)

(ALO-3997-T1) Avail: NTIS HC A03/MF A01

Frequency conversion techniques were studied to provide sufficient generation of ultraviolet wavelengths suitable for isotope separation. The process of stimulated Raman scattering is a promising technique for efficient energy conversion to the 16 micrometer region. DOE

N79-28542# Bendix Corp., Kansas City, Mo.

FINITE ELEMENT ANALYSIS OF LASER WELDING INDUCED THERMAL SHOCK

K. Sidorowicz Nov. 1978 21 p refs Presented at the Am. Soc. for Metals Appl. of Lasers to Mater., Washington D. C., 18 Apr. 1978

(Contract EY-76-C-04-0613)

(BDX-613-2118; Conf-7804104-1) Avail: NTIS HC A02/MF A01

The thermal and mechanical responses of a weldment involving a girth fillet weld are approximated by the finite element method and an isothermal ring heat source. Approximately 0.1 ms after the application of the ring heat source, the radial traction at an analytically predicted depth and location within the weldment exceeds the failure strength in tension, followed by fracture. Swelling and elongation of the weldment are in evidence in the general vicinity of the ring heat source. Loading characteristics of a corrective fixture are applied to control the radial traction and dilational motion and to gain design/processing knowledge. The analytical model yields an insight into the physical behavior of the subject weldment during CO2 laser beam welding.

Author (DOE)

N79-28543# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.

NONEQUILIBRIUM PHOTOCHEMICAL REACTIONS INDUCED BY LASERS Technical Progress Report

J. I. Steinfeld 15 Jan. 1979 84 p refs

(Contract EY-76-S-02-2793)

(MIT-2793-14) Avail: NTIS HC A05/MF A01

Infrared double resonance spectroscopy was carried out on

SF6 molecules excited with a CO2 laser, using a tunable diode laser as the probe source. Power broadening induced by the pump beam, transitions in the 2V sub 3 reverse arrow V sub 3 manifold, and relaxations within the V sub 3 vibrational level brought about by collisions between SF6 and other molecules of SF6, He, and CH3F were observed. Results indicate that rotational broadening of the excited-state absorption band envelopes may play a significant role in anharmonicity compensation, and that rotational relaxation proceeds mainly by collisions which reorient the angular momentum with respect to the internal coordinates of the SF6 molecule, but leave the total J quantum number nearly unchanged. Progress is also reported in the study of reactions induced by multiple infrared photon excitation. The dehydrohalogenation of R sub 2 C = CHCl systems (R = H, CH3, F) were examined for the vinyl carbene (R sub 2 C = C:) intermediate. DOE

N79-28544# Bendix Corp., Kansas City, Mo.
LASER INTERFEROMETRIC MEASUREMENT OF SPHERICAL SURFACE CONTOURS
P. E. Klingsporn Feb. 1979 60 p refs
(Contract EY-76-C-04-0613)
(BDX-613-2050-Rev) Avail: NTIS HC A04/MF A01

A laser interferometer was made operational for alignment of highly reflective spheres in a laser surface inspection system and for semi-automated measurement of roundness and waviness amplitude of the spherical surfaces. The noncontact interferometric measurements of roundness agree with conventional measurements made with a stylus. The theoretical foundation was developed for a computer program to perform semi-automated measurement of waviness wavelength associated with the measured waviness amplitude. Theory was developed for using the interferometer to position the center of a sphere on a rotation axis when the laser beam is accessible to only one-quarter revolution of the spherical surface about this axis. DOE

N79-28545# Los Alamos Scientific Lab., N. Mex.
USE OF THE SMARTT INTERFEROMETER AS AN ALIGNMENT TOOL FOR INFRARED LASER SYSTEMS
V. K. Viswanathan and P. D. Bolen 1979 8 p refs Presented at the Scanning-Electron Microscopy Conf., Washington, D. C., 16 Apr. 1979
(Contract W-7405-eng-36)
(LA-UR-79-890; Conf-790418-3) Avail: NTIS HC A02/MF A01

The ability to minimize the pointing and focusing errors at the focal plane is crucial in many applications involving infrared laser systems. This is particularly the case for systems involving multiple beams reaching the focal plane, as in the case of the LASL CO2 laser fusion systems. For example, the LASL Helios CO2 Laser Fusion System has eight 34-cm diameter beams each with an f number of approximately 2.4 coming to focus, the last element being an off-aperture parabola with a focal length of approximately 77.3 cm. The design tolerance for pointing accuracy is + 25 microns and for focusing accuracy is + or - 50 microns for the Helios system. The Smartt interferometer shows promise of not only evaluating the optical quality of the beam, but it can be used to align the beam to the tolerance levels stated above. The procedure, as well as experimental results obtained are described which show that pointing accuracies of + or - 12.5 microns and focusing accuracies of + or - 25 microns are obtained at the focus of a CO2 laser beam in a setup which duplicates the target region of the Helios CO2 Laser Fusion System. DOE

N79-28546# National Bureau of Standards, Boulder, Colo. Electromagnetic Technology Div.
MEASUREMENT OF PULSED-LASER POWER
M. Young and R. A. Lawton Feb. 1979 42 p refs Sponsored in part by Aerospace Guidance and Metrology Center
(PB-294049/2; NBS-TN-1010) Avail: NTIS HC A03/MF A01 CSCL 20F

The calibration of several optical-pulse power meters to an accuracy of about 8% or better are described. The meters are designed for Q-switched neodymium lasers with peak powers in excess of a few megawatts and pulses longer than five or ten nanoseconds. Combined with a fast oscilloscope or a transient digitizer, the meters display the time-domain waveform of the laser emission and thereby allow determination of parameters such as transition duration (risetime, falltime), duration and peak power. The calibration of the meters by both pulsed and cw methods are described, and it is shown why each method is useful as a check on the other. The effect of speckle on the use of diffusers as attenuators in power meters is treated in some detail. GRA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N79-28547 California Univ., Berkeley.
INFRARED RADIATION STUDIES INCLUDING APPLICATIONS TO PISTON COMPRESSION Ph.D. Thesis
Kee Hung Chu 1978 111 p
Avail: Univ. Microfilms Order No. 7914599

The unsteady heat transfer from a gas to the walls of a chamber is studied during piston compression in the presence of combustion. The problem is formulated in terms of a one-dimensional model corresponding to the end wall transport phenomenon and the combustion zone is modeled as a heat source of zero thickness. The basic equations and boundary condition are presented including the contribution of thermal radiation. Required inputs are the flame speed, pressure and free stream temperature which should be obtained from experiments. A study was made of initial, pre-ignition period of the compression process. The effects of thermal radiation and variable specific heats are included. Specific results were obtained for carbon dioxide and the effect of thermal radiation is seen to increase the heat transfer and decrease the gas temperatures. Dissert. Abstr.

N79-28548 California Univ., Berkeley.
STUDIES OF WALL FLAME QUENCHING AND HYDROCARBON EMISSIONS IN A MODEL SPARK IGNITION ENGINE Ph.D. Thesis
Nobuhiko Ishikawa 1978 106 p
Avail: Univ. Microfilms Order No. 7914647

Unburned hydrocarbon formation due to wall flame quenching was studied. The wall flame quenching process, combustion processes, and flow characteristics in an engine under various conditions were observed to obtain qualitative information for clarifying wall flame quenching mechanisms and then contribute to better design of engines to reduce hydrocarbon emissions. Effects of geometry, equivalence ratio, and ignition timing on the unburned hydrocarbon formation were examined. It was concluded that wall turbulence can significantly increase the effective quench layer thickness, and that the key to minimizing wall flame quenching is to reduce turbulence generated near the engine cylinder walls. Dissert. Abstr.

N79-28549* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SHOCK ISOLATOR FOR OPERATING A DIODE LASER ON A CLOSED-CYCLE REFRIGERATOR Patent
Donald E. Jennings, inventor (to NASA) (NAS-NRC) Issued 17 Jul. 1979 6 p Filed 24 Feb. 1978 Supersedes N78-19515 (16 - 10, p 1312) Sponsored by NASA
(NASA-Case-GSC-12297-1; US-Patent-4,161,747; US-Patent-Appl-SN-880838; US-Patent-Class-357-82; US-Patent-Class-357-83; US-Patent-Class-357-74; US-Patent-Class-357-79; US-Patent-Class-357-81; US-Patent-Class-165-105) Avail: US Patent and Trademark Office CSCL 20E

A diode laser mounted within a helium refrigerator is mounted using a braided copper ground strap which provides good impact shock isolation from the refrigerator cold-tip while also providing a good thermal link to the cold-tip. The diode mount also contains a rigid stand-off assembly consisting of alternate sections of nylon and copper which serve as cold stations to improve thermal isolation from the vaccum housing mounting structure. Included in the mount is a Pb-In alloy wafer inserted between the cold-tip and the diode to damp temperature fluctuations occurring at

the cold-tip.
Official Gazette of the U.S. Patent and Trademark Office

N79-28550* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TOGGLE MECHANISM FOR PINCHING METAL TUBES Patent
Edwin O. Stengard, inventor (to NASA) Issued 3 Jul. 1979 6 p Filed 19 May 1978 Supersedes N78-25428 (16 - 16, p 2122)
(NASA-Case-GSC-12274-1; US-Patent-4,159,634; US-Patent-Appl-SN-909100; US-Patent-Class-72-436; US-Patent-Class-72-451; US-Patent-Class-72-470; US-Patent-Class-251-7) Avail: US Patent and Trademark Office CSCL 13I

A toggle mechanism pinches a metal tube and maintains the tube in a pinched condition, without fracturing. The toggle mechanism includes a plunger translatable along a longitudinal axis, as well as a pair of links pivoted about a common axis extending through an end of the plunger. One of the links also pivots about a fixed axis. A free end of the other link carries a push link which the other link translates at right angles to the plunger longitudinal axis. First and second sides of the tube bear against a first stop block and are engaged by the push link when a compression spring, attached to the plunger, is suddenly released to irreversibly drive the plunger along its longitudinal axis so the pivot point of the two links is driven to an over travel position.
Official Gazette of the U.S. Patent and Trademark Office

N79-28551* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CONTROLLER ARM FOR A REMOTELY RELATED SLAVE ARM Patent
John K. Salisbury, Jr., inventor (to NASA) (Stanford Univ., Calif.) Issued 10 Jul. 1979 11 p Filed 19 Aug. 1977 Supersedes N77-30751 (15 - 21, p 2841) Sponsored by NASA
(NASA-Case-ARC-11052-1; US-Patent-4,160,508; US-Patent-Appl-SN-826202; US-Patent-Class-414-4) Avail: US Patent and Trademark Office CSCL 13I

A segmented controller arm configured and dimensioned to form a miniature kinematic replica of a remotely related slave arm is disclosed. The arm includes: (1) a plurality of joints for affording segments of the arm simultaneous angular displacement about a plurality of pairs of intersecting axes, (2) a plurality of position sensing devices for providing electrical signals indicative of angular displacement imparted to corresponding segments of the controller shaft about the axes, and (3) a control signal circuit for generating control signals to be transmitted to the slave arm. The arm is characterized by a plurality of yokes, each being supported for angular displacement about a pair of orthogonally related axes and counterbalanced against gravitation by a cantilevered mass.
Official Gazette of the U.S. Patent and Trademark Office

N79-28552 British Library Lending Div., Boston Spa (England).
INFLUENCE OF FUEL-AIR MIXTURE IMPOVERISHMENT ON THE OPERATING PARAMETERS OF A FIAT 126 A 1076 ENGINE
T. Wojciechowski and H. Rokowski May 1979 18 p Transl. into ENGLISH from Podstawy Budowy Silnikow Spalinowych (Poland) p 241-252
(BLL-RTS-11760) Avail: British Library Lending Div., Boston Spa, Engl.

Increased-performance tests were conducted by a research team from the Vehicle Engineering Institute of Lodz University of Technology (Bielsko-Biala Branch) and the Economy Car R & D Center. The results of tests of a Fiat 126 A1.076 engine (650 cubic centimeters version for installation in Polski Fiat 126P car) equipped with a 28 IMB-5 production carburettor were presented. Also tested was a PC (pneumatic carburation) feed device allowing engine operation on poor mixtures. M.M.M.

N79-28553 British Library Lending Div., Boston Spa (England).
A CONTRIBUTION TO EXPLANATION OF PROCESSES IN THE CUTTING OF THIN SHEET MATERIAL
M. Feiler Jul. 1979 134 p Transl. into ENGLISH of "Ein Beitrag Zur Klarueng Der Vorgaenge Beim Schneiden Duenner Flaechiger Materialien", Stuttgart Univ.
(BLL-RTS-11505) Avail: British Library Lending Div., Boston Spa, Engl.

The processes applied in industrial practice to the continuous cutting of thin flat materials like paper, aluminum foil, and artificial laminates were described. The importance of rotary shearing and straight edge cutting was stressed. The hypotheses of optimizing cutting conditions for these processes were examined. M.M.M.

N79-28554*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELASTOHYDRODYNAMIC FILM THICKNESS MEASUREMENTS OF ARTIFICIALLY PRODUCED NONSMOOTH SURFACES
C. Cusano (Illinois Univ., Urbana) and L. D. Wedeven 1979 47 p refs Proposed for presentation at Joint Lubrication Conf., Dayton, Ohio, 16-18 Oct. 1979; sponsored by Am. Soc. of Lubrication Engr. and the ASME
(NASA-TM-79214; E-9977) Avail: NTIS HC A03/MF A01 CSCL 11H

Optical interferometry is used to measure the elastohydrodynamic (EHD) film thickness associated with artificially produced nonsmooth surfaces. The nonsmooth surfaces are produced by modifying the surfaces of highly-polished balls with irregularities in the form of multiple grooves and dents. By closely spacing these irregularities it is possible not only to produce depressions on the surface of the balls but also to generate pseudo asperities. The average roughness wavelength of this artificially-produced, nonsmooth, surface approximates the average fundamental roughness wavelength found on surfaces of some mechanical elements operating under concentrated contact. By comparing the measured film thickness profiles to the stylus traces of the irregularities, it was possible to observe the local deformations associated with micro-EHD pressure generation. In both pure rolling and pure sliding conditions the artificially-produced asperities are deformed and complete separation exists between them and the mating surface. Such findings demonstrate the importance of local surface topography and resulting micro-EHD effects on the film thickness between rough surfaces in concentrated contact. Sliding data are presented which demonstrate a severe constriction, caused by the irregularities, at the exit of the Hertzian region. Author

N79-28555# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
OFF-DESIGN PERFORMANCE OF GAS TURBINES, VOLUME 1
1978 349 p refs Lectures held at Rhode-Saint-Genese, Belgium, 30 Jan. - 3 Feb. 1978 2 Vol.
(VKI-Lec-Ser-1978-2-Vol-1) Avail: NTIS HC A15/MF A01

The off-design performance of gas turbines is discussed in a series of lectures. Reviews of numerical analysis methods, computerized methods, stalling performance prediction, influence of particular variables, etc., are included. For individual titles, see N79-28556 through N79-28561.

N79-28556# Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Villaroche (France).
THE IMPORTANCE OF OFF-DESIGN OPERATION
Roger P. Bouillet *In* Von Karman Inst. for Fluid Dyn. Off-Design Performance of Gas Turbines, Vol. 1 1978 39 p (For primary document see N79-28555 19-37)
Avail: NTIS HC A15/MF A01

Contributing factors, component performance prediction methods, and overall performance prediction methods are reviewed. It is concluded that prediction of off-design performance is essential and that it must cover both steady and transient running performance. Author (ESA)

N79-28557# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
THE PREDICTION OF COMPRESSOR BLADE ROW PERFORMANCE: NUMERICAL METHODS AND THEORETICAL APPROACHES
R. vandenBraembussche *In its* Off-Design Performance of Gas Turbines, Vol. 1 1978 93 p refs (For primary document see N79-28555 19-37)
Avail: NTIS HC A15/MF A01

The present status of prediction methods for fluid mechanics in turbomachines is reviewed. The substitution of analytical methods by numerical methods applicable to more complex geometries is discussed. Author (ESA)

N79-28558# Brown, Boveri and Co., Ltd., Baden (Switzerland).
A THREE DIMENSIONAL FLOW COMPUTING SYSTEM APPLICABLE TO AXIAL AND RADIAL FLOW TURBOMACHINES
M. Ribaut *In* Von Karman Inst. for Fluid Dyn. Off-Design Performance of Gas Turbines, Vol. 1 1978 44 p refs (For primary document see N79-28555 19-37)
Avail: NTIS HC A15/MF A01

The justification for and application to examples of a potential method are presented. Current interest in the method due to its simplicity and accuracy is noted. Calculations are described including the calculation of the velocity field on a surface of revolution, the calculation of an axisymmetric solution, and the description of the effects of the three variables describing the velocity field, that is boundary surface, viscosity, and compressibility of the fluid. Graphic examples of applications are given. ESA

N79-28559# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
PREDICTION OF COMPRESSOR BLADE ROW PERFORMANCE: A CRITICAL APPRAISAL OF AVAILABLE CORRELATIONS
J. Fabri *In* Von Karman Inst. for Fluid Dyn. Off-Design Performance of Gas Turbines, Vol. 1 1978 19 p refs (For primary document see N79-28555 19-37)
Avail: NTIS HC A15/MF A01

Estimation methods for flow deviation at the blade cascade outlet, losses at design and off-design point operation as well as performance calculations were analyzed. Lack of generality (reproducibility outside the development group) is noted. Nonetheless these methods are useful as guidelines for the development of future engines. Author (ESA)

N79-28560# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
UNSTABLE FLOW REGIMES, INCLUDING ROTATING STALL, SURGE, DISTORTIONS, ETC.
J. Fabri *In* Von Karman Inst. for Fluid Dyn. Off-Design Performance of Gas Turbines, Vol. 1 1978 22 p refs (For primary document see N79-28555 19-37)
Avail: NTIS HC A15/MF A01

A time dependent model of the response of the total flow to the aerodynamic solicitations at conditions favorable for the onset of stall was analyzed. Simplified special cases are discussed. Theory and experiment compare accurately in some limited cases. The main difficulties appear when the perturbations are not of a limited amplitude, when the hub-to-tip ratio of the compressor becomes small, and when compressibility effects have to be taken into account. Author (ESA)

N79-28561# Rolls-Royce Ltd., Bristol (England).
AXIAL TURBINE PERFORMANCE PREDICTION
R. J. Latimer *In* Von Karman Inst. for Fluid Dyn. Off-Design Performance of Gas Turbines, Vol. 1 1978 119 p (For primary document see N79-28555 19-37)
Avail: NTIS HC A15/MF A01

Turbine off-design behavior and performance predictions are reviewed. Actual turbine behavior is covered showing test results from which a generalized pattern results. Difficulties predicting the off-design behavior are shown by the multiplicity of methods that have been published. Design point prediction methods including possible developments are discussed in detail. The effect of design point and off-design prediction methods on design criteria is commented on. A further problem, that it will probably be necessary to consider the precise blade shape and not just its overall parameters, is also mentioned. A method of performance estimation for axial flow turbines is presented as an appendix. Author (ESA)

N79-28562# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
OFF-DESIGN PERFORMANCE OF GAS TURBINES, VOLUME 2
1978 225 p refs Lecture held at Rhode-Saint-Genese, Belgium, 30 Jan. - 3 Feb. 1978 2 Vol.
(VKI-Lec-Ser-1978-2-Vol-2) Avail: NTIS HC A10/MF A01

The off-design performance of gas turbines is discussed in a series of lectures. In particular the gas turbine off-design computing system, the calculations of the dynamic behavior of industrial turbocompressor systems, and the problems involved in starting and shutdown of gas turbines are studied. For individual titles, see N79-28563 through N79-28565.

N79-28563# Brown, Boveri and Co., Ltd., Baden (Switzerland).
A GAS TURBINE OFF-DESIGN COMPUTING SYSTEM
Utz Klingenboeck and Axel vonRappard *In* Von Karman Inst. for Fluid Dyn. Off-Design Performance of Gas Turbines, Vol. 2 1978 94 p refs (For primary document see N79-28562 19-37)
Avail: NTIS HC A10/MF A01

A program for the design of gas turbine plants is described. The program was written for an IBM 370/618 computer using FORTRAN 4 language, 450 KB program length, punched cards input, and print-out output. Program requirements and basic concepts are explained. The calculation method is discussed in detail. Input and output specifications are considered. Aerodynamic characteristics taken into consideration by the computer procedure are discussed. An example is presented. Author (ESA)

N79-28564# Gutehoffnungshuette Sterkrade A.G. (West Germany).
CONTRIBUTION TO THE CALCULATION OF THE DYNAMIC BEHAVIOR OF INDUSTRIAL TURBOCOMPRESSOR CIRCUITS
Heinrich Voss *In* Von Karman Inst. for Fluid Dyn. Off-Design Performance of Gas Turbines, Vol. 2 1978 34 p refs (For primary document see N79-28562 19-37)
Avail: NTIS HC A10/MF A01

A calculation method was developed which can predict the required turbocompressor circuits performance from data on the various individual components. The method is based on a components indexing system which, after numeric editing of the plant to be investigated, forms a circuit matrix. The program contains a set of indexed components which are treated by a processing computer using digital programming techniques. Initial comparison of precalculations and measurements indicate agreement. Two examples are presented. Author (ESA)

N79-28565# Ateliers de Constructions Electriques de Charleroi (Belgium).
PROBLEMS INVOLVED IN STARTING AND SHUTDOWN OF GAS TURBINES: THERMODYNAMIC AND MECHANICAL ASPECTS
J.-L. Guiette and Albert VanGucht *In* Von Karman Inst. for Fluid Dyn. Off-Design Performance of Gas Turbines, Vol. 2 1978 95 p refs (For primary document see N79-28562 19-37)
Avail: NTIS HC A10/MF A01

A calculation method for the transient performances of the turbine and compressor is given and the assumptions are pointed out. Although simplifications are introduced, the work involved in determining start up and shutdown characteristics is considerable. Differences occur between measured and calculated data, but they can be explained by the simplifications made. The accuracy of the calculation method is considered satisfactory. Author (ESA)

N79-28566# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
OFF-DESIGN PERFORMANCE OF PUMPS, VOLUME 1
1978 515 p refs Lecture held at Rhode-Saint-Genese, Belgium, 6-8 Mar. 1978 2 Vol.
(VKI-Lec-Ser-1978-3-Vol-1) Avail: NTIS HC A22/MF A01

Performance prediction and off-design analysis of axial flow and centrifugal pumps are surveyed. Design procedures, new computer programs to simulate pump flow, a discussion of cavitation, and prerotation are reviewed. For individual titles, see N79-28567 through N79-28574.

N79-28567# National Engineering Lab., East Kilbride (Scotland). Fluid Mechanics Div.

PUMP DESIGN
I. S. Pearsall *In* Von Karman Inst. for Fluid Dyn. Off-Design Performance of Pumps, Vol. 1 1978 14 p (For primary document see N79-28566 19-37)
Avail: NTIS HC A22/MF A01

The isolated airfoil method with corrections for blade interference, the cascade method, and the actuator disks method are reviewed. Formulas are developed and limitations and restrictions are explained. Author (ESA)

N79-28568# National Engineering Lab., East Kilbride (Scotland).
A COMPUTER-AIDED DESIGN METHOD FOR AXIAL FLOW PUMPS AND FANS
J. E. Hesselgreaves and O. McEwan *In* Von Karman Inst. for Fluid Dyn. Off-Design Performance of Pumps, Vol. 1 1978 40 p refs (For primary document see N79-28566 19-37)
Avail: NTIS HC A22/MF A01

Programs for the design of axial flow pumps and fans with or without stator rows are described. Controlled variation of spanwise loading is incorporated into the method which is valuable where special design requirements are to be met. The methods of analysis are described together with the organization of the programs. Some numerical results are given together with supporting experimental evidence. Author (ESA)

N79-28569# National Engineering Lab., East Kilbride (Scotland). Fluid Mechanics Div.
A METHOD FOR THE ANALYSIS OF INCOMPRESSIBLE FLOW ON AN AXISYMMETRIC SURFACE THROUGH A PUMP OR FAN BLADE ROW
A. N. Neal *In* Von Karman Inst. for Fluid Dyn. Off-Design Performance of Pumps, Vol. 1 1978 67 p refs (For primary document see N79-28566 19-37)
Avail: NTIS HC A22/MF A01

A method of blade-to-blade analysis is described in which a potential flow calculation is used alternately with a boundary layer approximation until a converged solution is obtained. The conditions for positive and negative incidence stall, with the fluid deflection and energy losses between these limits, are predicted. Instructions are give for the use of an interactive computer program which performs the calculations. The program is useful in the analysis and modification of existing designs and in the disign of new machines. Author (ESA)

N79-28570# National Engineering Lab., East Kilbride (Scotland).
CAVITATION
I. S. Pearsall *In* Von Karman Inst. for Fluid Dyn. Off-Design Performance of Pumps, Vol. 1 1978 45 p refs (For primary document see N79-28566 19-37)
Avail: NTIS HC A22/MF A01

Cavitation in fluid systems is reviewed. Basic definitions are given. Cavitation erosion, hydrofoil cavitation, cavitation in pumps, off-design cavitation performance, and supercavitating pumps and inducers are discussed. Author (ESA)

N79-28571# Bergeron S.A., Paris (France).
ACTUAL BEHAVIOR OF PUMPS OUTSIDE THEIR HIGH EFFICIENCY RANGE: A TENTATIVE STUDY
P. Guiton *In* Von Karman Inst. for Fluid Dyn. Off-Design Performance of Pumps, Vol. 1 1978 134 p (For primary document see N79-28566 19-37)
Avail: NTIS HC A22/MF A01

A general survey is made. External behavior, as observed by users, and internal behavior, as seen by designers, are discussed. Four quadrant characteristics, energy dissipation and losses, cases of far-off operation, behavior at partial flow, and other subjects are reviewed for different classes of pumps. Author (ESA)

N79-28572# Ateliers de Constructions Electriques de Charleroi (Belgium).
MIXED FLOW IMPELLER TESTS
P. Hance *In* Von Karman Inst. for Fluid Dyn. Off-Design Performance of Pumps, Vol. 1 1978 54 p (For primary document see N79-28566 19-37)
Avail: NTIS HC A22/MF A01

A computer program to compute flow using a quasi-dimensional mathematical model that analyzes flow in the meridional plane was verified. This method was used to compute the flow in a mixed type impeller without introducing boundary layer or loss effects. The test was conducted on a classical design, 175 mm diameter at 1.500 rpm, on a test rig for collecting local velocity and pressure measurements. The mathematical model used does not fit well with the actual flow pattern and a more sophisticated measurement system is necessary to determine the effect of the location of the probes. The theoretical key to numerical solution consists in using a three dimensional computer program, analyzing the complete hydraulic cell.
Author (ESA)

N79-28573# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
PREROTATION IN CENTRIFUGAL PUMPS
Mete Sen *In its* Off-Design Performance of Pumps, Vol. 1, 1978 51 p refs (For primary document see N79-28566 19-37)
Avail: NTIS HC A22/MF A01

The influence of pump design on prerotation was studied in two series of pumps with different volutes. Each had the same meridional shape and blade profile as the impeller, but a varied blade number. At a lower than critical output, prerotation and reverse flow appears at the inlet. The inlet flow becomes three dimensional and asymmetric. Effects of prerotation and reverse flow on pump performance and stability were not demonstrated. Drops in efficiency and low head at small deliveries are attributed to the asymmetry of the exit flow field causing mixing losses in the volute and to boundary layer separation as well as secondary flow in the impeller channel. Author (ESA)

N79-28574# Worthington Pump International, Inc., Desio (Italy).
PREROTATION IN CENTRIFUGAL PUMPS: DESIGN CRITERIA
A. Janigro and B. Schiavello *In* Von Karman Inst. for Fluid Dyn. Off-Design Performance of Pumps, Vol. 1, 1978 100 p refs (For primary document see N79-28566 19-37)
Avail: NTIS HC A22/MF A01

After a survey of the literature complemented by flow visualization and flow measurement tests, a qualitative scheme was conceived for the interpretation of the main phenomena related to separation, backflow, and prerotation in centrifugal pumps. An identical sequence, separation-backflow-rotation, develops at part capacities in centrifugal, mixed, and axial rotors. Onset of these phenomena is discussed and related to pump design as well as operation characteristics. Author (ESA)

N79-28575# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
PUMPS FOR NUCLEAR APPLICATIONS
1978 181 p refs Lecture held at Rhode-Saint-Genese, Belgium, 9-10 Mar. 1978 2 Vol.
(VKI-Lec-Ser-1978-3-Vol-2) Avail: NTIS HC A09/MF A01

A series of lectures is presented. The main subjects are design criteria, design codes, description of particular pumps, fluidic applications, and the rules for quality control, safety, and seismic design, etc. For individual titles, see N79-28576 through N79-28583.

N79-28576# Klein, Schanzin und Becker A.G., Frankenthal (West Germany).
DESIGN, QUALITY CONTROL, RELIABILITY TESTING, MAINTENANCE
R. Dernedde *In* Von Karman Inst. for Fluid Dyn. Pumps for Nucl. Appl. 1978 18 p (For primary document see N79-28575 19-37)
Avail: NTIS HC A09/MF A01

A description of present day nuclear pump technology is given. Reactor coolant pumps and auxiliary pumps are briefly surveyed. Necessity of traceability of pump technical documents and inclusion of operability concepts in codes and rules is emphasized. Conflicting design requirements, preventive maintenance criteria, and other related subjects are discussed.
Author (ESA)

N79-28577# Klein, Schanzin und Becker A.G., Frankenthal (West Germany).
DETAILED DESCRIPTION OF A MAIN COOLANT PUMP
R. Dernedde *In* Von Karman Inst. for Fluid Dyn. Pumps for Nucl. Appl. 1978 14 p (For primary document see N79-28575 19-37)

Avail: NTIS HC A09/MF A01

A 175 bar design pressure, 25,000 cu m/hr capacity, 125 m total head 1500 rpm, main coolant pump, choosen for a pressurized water reactor, is described. Author (ESA)

N79-28578# Ateliers de Constructions Electriques de Charleroi (Belgium).

CHARGING SAFETY INJECTION PUMP

P. Hance *In* Von Karman Inst. for Fluid Dyn. Pumps for Nucl. Appl. 1978 42 p (For primary document see N79-28575 19-37)

Avail: NTIS HC A09/MF A01

A 12 stage centrifugal pump used for safety charging in a nuclear reactor system is described. A pump test to demonstrate the reliability of the pump in withstanding a thermal transient from 20 C to 149 C is discussed. Rotor photographs illustrate the effects of thermal shock during the test program.

Author (ESA)

N79-28579# Weir Pumps Ltd., Glasgow (Scotland).

SOME ASPECTS OF THE HYDRAULIC AND MECHANICAL DESIGN OF PUMPS FOR NUCLEAR APPLICATIONS

A. B. Duncan *In* Von Karman Inst. for Fluid Dyn. Pumps for Nucl. Appl. 1978 40 p refs (For primary document see N79-28575 19-37)

Avail: NTIS HC A09/MF A01

The establishing of design standard systems to guarantee that minimum performances are achieved and that their international recognition becomes mandatory is discussed. As an introduction to some of the design standard problems the more important design considerations from a list of main components are reviewed. Author (ESA)

N79-28580# Weir Pumps Ltd., Glasgow (Scotland).

NOTES ON THE JUSTIFICATION OF SOME MECHANICAL FEATURES IN THE DESIGN OF PUMPS FOR NUCLEAR APPLICATIONS

J. R. McEwan *In* Von Karman Inst. for Fluid Dyn. Pumps for Nucl. Appl. 1978 11 p (For primary document see N79-28575 19-37)

Avail: NTIS HC A09/MF A01

Design details and justification of design criteria are discussed. The pump is part of a boron injection system which is a feature of a Westinghouse pressurized water reactor. Its primary function is to borate the reactor in the event of an accident. A check list for design calculations is given as an appendix.

Author (ESA)

N79-28581# Sheffield Univ. (England). Dept. of Chemical Engineering and Fuel Technology.

FLUIDIC PROCESS-FLUID CONTROL IN NUCLEAR PLANTS

J. R. Tippetts *In* Von Karman Inst. for Fluid Dyn. Pumps for Nucl. Appl. 1978 9 p refs Sponsored by UKAEA, Risley, Engl. (For primary document see N79-28575 19-37)

Avail: NTIS HC A09/MF A01

Pressure boundaries, fatigue analysis, thermal ratchet analysis rotor dynamics, and seismic analysis are discussed. The use of section 3 of the ASME boiler and pressure vessel code as well as applications of the finite elements method are emphasized. Examples of typical fatigue analyses, thermal ratchet analyses and seismic analyses are presented. Author (ESA)

N79-28582# Sheffield Univ. (England). Dept. of Chemical Engineering and Fuel Technology.

FLUIDIC PUMPS FOR TOXIC LIQUIDS

J. R. Tippetts *In* Von Karman Inst. for Fluid Dyn. Pumps for Nucl. Appl. 1978 18 p refs Sponsored by UKAEA, Risley, Engl. (For primary document see N79-28575 19-37)

Avail: NTIS HC A09/MF A01

Topics related to fluidic processes and fluid handling systems are described. Advantages are claimed in the use of large-scale fluidic devices for the direct control of toxic fluids. Two all-fluidic prototype pumps are described along with a liquid-jet tank stirrer. It is shown that multistage pumps are advantageous in achieving very high pumping heads. A line of newly developed rectifier components is described. Author (ESA)

N79-28583# Electricite de France, Chatou.

PUMPS FOR NUCLEAR APPLICATIONS: THE USER'S POINT OF VIEW

J. Magne and R. Simon *In* Von Karman Inst. for Fluid Dyn. Pumps for Nucl. Appl. 1978 20 p (For primary document see N79-28575 19-37)

Avail: NTIS HC A09/MF A01

General aspects of the problem, such as evaluation of operating conditions, design principles, performance tests, and adaptation to required functions, are discussed. As an example of pump applications, the auxiliary feedwater pump is cited.

Author (ESA)

N79-28584# Naval Ship Research and Development Center, Bethesda, Md. Ship Materials Engineering Dept.

PLASMA ARC WELDING OF HIGH-PERFORMANCE-SHIP MATERIALS

Robert L. McCaw May 1979 91 p refs

(AD-A068722; DTNSRDC/SME-78/34) Avail: NTIS HC A05/MF A01 CSCL 13/8

The plasma arc welding process has been evaluated for use in the fabrication of high-performance-ship materials, which include HY steels, PH stainless steels, and titanium and aluminum alloys. Welding parameters and mechanical properties of plasma arc keyhole mode welds in varying thicknesses were determined for the above materials. Additional information was generated through an evaluation of the commercial practice of plasma arc welding. It was found that this type of welding is a viable fabrication technique for the intended application. The materials of interest can be welded from one side in one or two passes in thicknesses of 1/2 in. (12.5 mm) or less with less distortion than conventional arc welding processes. Filler metal consumption is minimal, mechanical properties are satisfactory, and required operator skill levels are not exceptionally high. The highly cost effective plasma arc welding process could be implemented with existing technology in the fabrication of high-performance-ship materials. GRA

N79-28585# Sandia Labs., Albuquerque, N. Mex.

JOINING BY PLATING: OPTIMIZATION OF OCCLUDED ANGLE

J. W. Dini, H. R. Johnson, and Y. R. Yan Nov. 1978 33 p refs

(Contract EY-76-C-04-0789)

(SAND-78-8027) Avail: NTIS HC A03/MF A01

An empirical method was developed for predicting the minimum angle required for maximum joint strength for materials joined by plating. This was done through a proposed power law failure function, whose coefficients were taken from ring shear and conical head tensile data for plating substrate combinations and whose exponent was determined from one set of plated joint data. Experimental results are presented for Al-Ni-Al joints. The failure function was used to predict joint strengths for Al-Ni-Al, UTi-Ni-Uti, and Be-Ti-Be. DOE

N79-28586# Oak Ridge Y-12 Plant, Tenn.

INERTIA AND FRICTION WELDING OF TYPE 1100 ALUMINUM TO TYPE 316 STAINLESS STEEL

M. A. Perkins Dec. 1978 25 p refs

(Contract W-7405-eng-26)

(Y-2165) Avail: NTIS HC A02/MF A01

Both the inertia and friction-welding processes were evaluated for jointing Type 1100-H14 aluminum to Type 316 VIM VAR stainless steel. While both processes consistently produce joints whose strength exceed the aluminum base metal, 100 percent bonding was not reliably achieved. This deficiency points out the need for the development of nondestructive testing techniques for this type of joint. Additionally, solid state volume diffusion did not appear to be a satisfactory explanation for the inertia and friction-welding bonding mechanism. DOE

N79-28587# Miami Univ., Coral Gables, Fla.

HYDROGEN ENGINE PERFORMANCE ANALYSIS Annual Report

R. R. Adt, Jr. Aug. 1978 318 p refs Prepared in cooperation with Hawthorne Research and Testing, Inc., Coral Gables, Fla.

(Contract EC-77-C-03-1212)

(SAN-1212-1; AR-1) Avail: NTIS HC A14/MF A01

Many problems associated with the design and development of hydrogen-air breathing internal combustion engines for automotive applications were identified by various domestic and foreign researchers. The problems identified in the literature are addressed, potential solutions to these problems are evaluated, and a design data-base is obtained and documented covering the performance, operational and emissions characteristics essential for making rational decisions regarding the selection and design of prototype hydrogen-fueled, airbreathing engine suitable for manufacture for general automotive use. Information is included on the operations, safety, emission, and cost characteristics of hydrogen engines, the selection of a test engine and testing facilities, and experimental results. DOE

N79-28588# Detroit Diesel Allison, Indianapolis, Ind.
GAS TURBINE ENGINES AND TRANSMISSIONS FOR BUS DEMONSTRATION PROGRAMS Technical Status Report, 31 Oct. 1978 - 31 Jan. 1979
D. N. Nigro Jan. 1979 6 p
(Contract EM-78-C-02-4867)
(COO-4867-2) Avail: NTIS HC A02/MF A01

The effort performed on the procurement of gas turbine engines and automatic transmissions and the require associated software for the bus demonstration programs is described. DOE

N79-28589# Battelle Columbus Labs., Ohio.
MECHANICAL BEHAVIOR OF 304 LN WELDMENTS
F. J. Jelinek Feb. 1979 10 p ref
(Contract W-7405-eng-48)
(UCRL-13971) Avail: NTIS HC A02/MF A01

Mechanical properties of various weld configurations for 304 LN stainless steel are reported. The results include Charpy V-notch, tensile, and fracture toughness data. The determinations were made at temperatures of 300, 77, and 4.2 K. Each of the three types of mechanical evaluations are treated separately. DOE

N79-28590# Research Inst. of National Defence, Stockholm (Sweden).
HYDRAULIC SERVO WITH PULSE MODULATED VALVES [HYDRAULSERVO MED PULSMODULERADE VENTILER]
Anders Sjoequist Jun. 1978 136 p refs In SWEDISH
(FOA-C-20244-E3) Avail: NTIS HC A07/MF A01

General properties of various kinds of modulation principle in pulsed control were investigated. A detailed theoretical account of the bang-bang with dead zone (BBDZ) control principle, based on the properties of valves is presented. Tests were run with a hydraulic motor to investigate how it controlled a steam regulator valve for a 100 MW generator turbine, in which the motor is controlled by a conventional servo valve. Tests with this hydraulic motor indicate that it is quite possible to replace the conventional analogue servo valve by two 2-positional magnetic valves while still retaining the required control capabilities. R.E.S.

N79-28591# Research Inst. of National Defence, Stockholm (Sweden).
INVESTIGATION OF POSITION AND VELOCITY RIPPLE IN A FLUID SERVO WITH PULSE MODULATED SEAT VALVES [UNDERSOEKNING AV LAEGES - OCH HASTIGHETSRIPPLE HOS ETT FLUIDSERVO MED PULSMODULERADE SAETESVENTILER]
Anders Sjoequist Jun. 1978 56 p In SWEDISH Sponsored partly by Swed. Board for Tech. Develop., Stal-Laval Turbin AB, and Saab-Scania
(FOA-C-20245-E3) Avail: NTIS HC A04/MF A01

Computer simulations of a 3rd-order system, in which the input signal is a pulse train are presented. Ripple in the position and the speed arising from the principle of pulsed control is plotted and is reported both in tabular form and as a special diagram to illustrate which combinations of pulse widths and pulse repetition rates should be avoided with respect to ripple. The diagram can therefore serve as a basis in choosing a modulation principle (pulse frequency modulation, pulse width modulation or combinations of these). The computer simulations were checked by test runs with a pulse-modulated pneumatic and a hydraulic servo. The result shows a rather inferior agreement between the simulated and measured values for ripple in the pneumatic servo. However, the agreement between these values for the hydraulic servo is very good. G.Y.

N79-28592# Bureau of Mines, Albany, Oreg. Metallurgy Research Center.
EROSION TESTING OF POTENTIAL VALVE MATERIALS FOR COAL GASIFICATION SYSTEMS
J. S. Hansen, J. E. Kelley, and F. W. Wood 1979 32 p refs
(PB-293308/3; BM-RI-8335) Avail: NTIS HC A03/MF A01 CSCL 13K

In support of its objective to conserve mineral resources by minimizing premature failure of materials, the Bureau of Mines conducted a cooperative study with the U.S. Department of Energy on the erosion and abrasion resistance of hard materials for valves in coal conversion systems. A developed erosion-testing apparatus is described and data on the erosion resistance of over 200 materials are presented. Erosion resistance of most metals was comparatively low. In contrast, ceramics and cermets such as B4C, WC, SiC, Si3N4, and TiB2, when fabricated to minimize porosity, displayed greater than five times the erosion resistance of metals. Coatings such as boron diffused into Mo and WC, chemical-vapor-deposited TiCN, and electrodeposited TiB2 were highly erosion resistant if applied in thicknesses ranging from 60 to 75 micrometers. Erosion resistance of cemented carbides was inversely related to metal binder content. GRA

N79-28593# Environmental Protection Agency, Ann Arbor, Mich. Standards Development and Support Branch.
ANALYSIS OF HOT/COLD CYCLE REQUIREMENTS FOR HEAVY-DUTY VEHICLES
Chester J. France Jul. 1978 76 p
(PB-293842/1; HDV-78-05) Avail: NTIS HC A05/MF A01 CSCL 13F

EPA is involved in the development of transient engine and chassis cycles from the CAPE-21 survey data. The CAPE-21 survey data was gathered from eighty-eight in-use trucks; forty-four in New York City and forty-four in Los Angeles. Vehicle speed, engine rpm, engine power, engine temperature, and various traffic and road describers were recorded on tape, at approximately one second intervals. Prior to the actual generation of the cycles, the need for a unique cold start cycle (engine and/or chassis) was investigated. This investigation is summarized. GRA

N79-28594# Little (Arthur D.), Inc., Cambridge, Mass.
EVALUATION OF AUTOMOBILE DRIVETRAIN COMPONENTS TO IMPROVE FUEL ECONOMY Final Report, Jun. 1975 - Nov. 1977
Donald Hurter and Philip Gott Mar. 1979 114 p refs
(Contract DOT-TSC-1046)
(PB-293728/2; DOT-TSC-NHTSA-79-12; DOT-HS-803-840) Avail: NTIS HC A06/MF A01 CSCL 13F

Wide ratio range automatic transmissions with lockup torque converters could be in production by the early 1980's. In order to evaluate their impact upon fuel economy, emissions, driveability, acceleration, and durability, four 1975 automobiles with inertia weights and engine sizes typical of that time period were equipped with Multi-Purpose Test Transmissions. Each of the test cars were evaluated in seven different transmission modes for fuel economy, emission, driveability, acceleration, and durability. Fuel economy test results were compared to computer predicted fuel economies. Predicted values agreed with actual fuel economies within the resolution of the test method. Composite fuel economy improvements of up to 14% were achieved with no change in acceleration and durability. GRA

N79-28595# Environmental Protection Agency, Ann Arbor, Mich. Standards Development and Support Branch.
TRANSIENT CYCLE ARRANGEMENT FOR HEAVY-DUTY ENGINE AND CHASSIS EMISSION TESTING
Chester J. France Aug. 1978 46 p
(PB-293764/7; HDV-78-04) Avail: NTIS HC A03/MF A01 CSCL 13F

Olson Laboratories, EPA's heavy-duty cycle development contractor, has generated various nominal 5-minute chassis and engine cycles from the CAPE-21 data base. The Emission Control Technology Division of EPA has in turn, selected the best cycle

in each category for which cycles were generated (both chassis and engine cycles). The final step in ECTD's HD transient cycle development effort is the arrangement of these five minute cycles into one cycle which exhibits the proper trip characteristics as determined from the CAPE-21 survey data. The cycle arrangement is identified that has the proper trip characteristics and which also meets certain practical requirements. Chassis and engine cycle arrangements for both HD gasoline and diesel vehicles are developed. The equations necessary for exhaust emission calculations are also presented. GRA

N79-28596# South Coast Technology, Inc., Santa Barbara, Calif.
ALTERNATE ENGINES: STATE OF THE ART STUDY Final Report, Nov. 1977 - Nov. 1978
Roy A. Renner Nov. 1978 85 p refs
(Contract DOT-HS-7-01790)
(PB-293940/3; DOT-HS-803-880) Avail: NTIS HC A05/MF A01 CSCL 21G

Eleven different advanced automobile engine types were examined as to the possibilities for introduction prior to 1990. An assessment was made based on extensive literature survey and extrapolation of learning curves toward future values of fuel economy and emissions. Gas turbines and external combustion engines are unlikely to be in general use prior to 1990. Stratified charge engine, the advanced diesel, and internal combustion engines with variable displacement features were considered to be likely candidates for use prior to 1990. These engines were analyzed and learning curves were determined for fuel economy predictions with exhaust emission constraints. GRA

N79-28367 Technical Univ. of Denmark, Lyngby. Dept. of Machine Elements.
EVALUATION OF STIFFNESS AND DAMPING COEFFICIENTS FOR FLUID-FILM BEARINGS
J. W. Lund *In* Shock and Vibration Inform. Center Shock and Vibration Dig., Vol. 11, No. 1 Jan. 1979 p 5-10 refs (For primary document see N79-28366 19-31)
Avail: SVIC, Code 8404, Naval Research Laboratory, Washington, D. C. 20375; $15.00/set

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N79-28597# Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
ULTRASONIC INSPECTION AND CONTROL OF WELDMENTS IN PRESSURE VESSELS AND THICKNESS MEASUREMENT FOR CORROSION VERIFICATION
L. X. Nepomuceno, M. F. Barbosa, and C. Feth 12 Oct. 1976 11 p In PORTUGUESE; ENGLISH summary
Avail: NTIS HC A02/MF A01

The weldments and the spots measured for thickness are decribed. The results are presented in schematics, with spot positioning. R.E.S.

N79-28598# Army Electronics Research and Development Command, Fort Belvoir, Va. Night Vision and Electro-Optics Labs.
LIFE CYCLE COST ANALYSIS MODEL. PART 1: THE MATHEMATICAL MODEL
David B. Sirota, Walter B. Morrow, Jr., Jerry P. Skelton, and Henry K. Sijgers Mar. 1979 49 p refs
(AD-A067882; DELNV-TR-0004-Pt-1) Avail: NTIS HC A03/MF A01 CSCL 09/2

Part I of this report describes the development of a mathematical model for the life cycle cost analysis of electronics, electro-optical, optical, and opto-mechanical systems. GRA

N79-28599# Army Missile Research and Development Command, Redstone Arsenal, Ala. Engineering Lab.
INFRARED INSPECTION OF PRINTED CIRCUITS
W. Tomme, Gordon D. Little, V. W. Ruwe, and L. C. Layfield 15 Dec. 1978 84 p refs
(AD-A068140; DRDMI-E-79-10) Avail: NTIS HC A05/MF A01 CSCL 14/2

A system has been demonstrated to have the capability to identify and isolate printed circuit wiring board flaws which are presently undetected by existing means. The demonstration system uses an infrared sensor and a scanner to read the thermal characteristics of an operating printed wiring board. The thermal measurements are digitized and computer processed to compare the board's thermal map with a prerecorded standard. The fault location coordinates are read out by the computer. The system is applicable to a production test environment where multiple test stations can be accommodated by the data processor. The selection of the appropriate sensors, scanner, data processor, and test algorithms have been optimized toward maximum sensitivity to fault detection, measurement repeatability, and cost effectiveness. Trade-offs of these parameters are discussed. GRA

N79-28600# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
CLASSIFICATION OF DEFICIENCIES AND SHORTCOMINGS Final Report
1 Apr. 1979 12 p refs Revised
(AD-A068750; TOP-1-1-012) Avail: NTIS HC A02/MF A01 CSCL 13/12

This document describes criteria intended to provide consistent guidance for classification of appropriate materiel test incidents and test results as deficiencies and shortcomings. It applies to the documentation of development tests, and product improvement tests. Consistent classification is essential in the proper evaluation of equipment suitability for Army use. All guidance concerning classification of test incidents is intended for use in properly classifying deficiencies, shortcomings, suggested improvements, and other incidents. GRA

N79-28601# Hanford Engineering Development Lab., Richland, Wash.
ULTRASONIC TECHNIQUES FOR IN-SERVICE INSPECTION OF AUSTENITIC STAINLESS STEEL WELDS AT 200 DEGREES C
S. J. Mech 1978 37 p refs Presented at ASNT Fall Conf., Denver, 20 Oct. 1978
(Contract EY-76-C-14-2170)
(HEDL-SA-1546; Conf-781008-6) Avail: NTIS HC A03/MF A01

Ultrasonic testing (UT) continues to be one of the most viable nondestructive testing (NDT) methods for preservice and inservice inspection of heat transport systems in the nuclear industry. In liquid metal-cooled reactors, these inspections must be conducted at high temperatures (200 C). Consequently, an important objective is to develop methods and equipment to examine austenitic stainless steel weldments at 200 C. DOE

N79-28602# National Technical Information Service, Springfield, Va.
RELIABILITY - MATHEMATICAL TECHNIQUES, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Jun. 1977 - Apr. 1979
George W. Reimherr May 1979 87 p Supersedes NTIS/PS-78/0439; NTIS/PS-77/0445; NTIS/PS-76/0221
(NTIS/PS-79/0451/9; NTIS/PS-78/0439; NTIS/PS-77/0445; NTIS/PS-76/0221) Avail: NTIS HC $28.00/MF $28.00 CSCL 14D

The cited reports discuss reliability prediction using mathematical techniques. Topics covered include statistical analysis, fault tree analysis, life testing, failure analysis, and mathematical models as applied to reliability prediction. GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N79-28603 Ohio State Univ., Columbus.
ELASTO-PLASTIC ANALYSIS FOR FINITE GEOMETRY

CRACKED MEMBERS BY THE METHOD OF LINES Ph.D. Thesis
Shah Nawaz Mohd Malik 1979 239 p
Avail: Univ. Microfilms Order No. 7916001

An analysis of the elasto-plastic response by using the method of lines (MOL) is presented. The MOL is a semi-analytic numerical method. The idea is to substitute the derivatives with respect to some independent variables, but not all, by finite differences. This approach replaces a given partial differential equations that can be solved either in closed form or numerically. An incremental, three-dimensional, elasto-plastic formulation and associated computational procedure utilizing the MOL were developed. The work-hardening behavior of material is taken care of through the effective stress and effective strain concepts. Governing field equations are obtained in terms of displacement increments. The MOL is applied to reduce these partial differential equations into coupled set of ordinary differential equations. The formulation is then applied to the cases of finite geometry fracture specimens. Dissert. Abstr.

N79-28604 Illinois Univ. at Urbana-Champaign.
NONDESTRUCTIVE TESTING OF FLEXIBLE PAVEMENTS Ph.D. Thesis
Marvin Lee Traylor, Jr. 1979 226 p
Avail: Univ. Microfilms Order No. 7915436

The wide range of load responses that result from nondestructive testing are explained and the capability of various combinations of laboratory material and structural schemes to simulate pavement response under dynamic loading is evaluated. Dissert. Abstr.

N79-28605 Texas Univ. at Arlington.
ANALYSIS OF RIBBED PLATES Ph.D. Thesis
Chao-Shih Li 1978 349 p
Avail: Univ. Microfilms Order No. 7915909

A numerical procedure using the finite element displacement method is presented to analyze a ribbed plate on a nonlinearly elastic foundation. An integration scheme is used to solve the nonlinear equilibrium equations numerically. Three computer programs are developed: (1) for a ribbed plate on a nonlinear foundation; (2) for a ribbed plate on a linear foundation; and (3) for a plate-grid system. A procedure using a combined classical and finite element approach to solve a plate problem is introduced. The plate region is divided into a finite element subregion and a classic solution subregion. To provide the compatibility and equilibrium at the connection boundary of these two subregions, an algorithm is demonstrated via two examples. Dissert. Abstr.

N79-28606 Purdue Univ., Lafayette, Ind.
AN INDIRECT TENSION TEST WITH APPLICATIONS TO FRACTURE OF BRITTLE MATERIALS Ph.D. Thesis
Kozo Mizutani 1978 162 p
Avail: Univ. Microfilms Order No. 7914934

Fracture properties of two typical brittle materials, i.e. glass and hardened cement paste, were studied using the proposed indirect tension test. The application included the measurements of fracture surface energy, moisture effect, effect of crack tip geometry and mixed mode fracture analysis. By using a tension ring, a uniform tensile stress field was generated in a plate sample. A calibration formula and the experimental method for the evaluation of the calibration constants are proposed. This tension-ring method has the advantage of simplicity in sample preparation procedure and high degree of reproducibility. More importantly, it imposes less restrictions on the adaptability of the method to the type of required loading machine, and it can be applied to a wide variety of brittle materials. Dissert. Abstr.

N79-28607 Illinois Univ. at Urbana-Champaign.
INELASTIC RESPONSE OF REINFORCED CONCRETE COLUMNS SUBJECTED TO TWO-DIMENSIONAL EARTHQUAKE MOTION Ph.D. Thesis
Mohammed Iobal Hasan Suharwardy 1979 225 p
Avail: Univ. Microfilms Order No. 7915433

The effects of two-dimensional earthquake motion on reinforced concrete (R/C) columns were determined. An analytical model to represent the shear-deflection-axial load relationship of R/C columns is developed from stress-strain relations of steel and concrete. Improved hysteresis model for steel included the Bauschinger effect and the model for concrete included the deterioration of strength and stiffness under cyclic loading. The analytical model compares favorably with experimental results for both uniaxial and biaxial loading conditions and predicts changes in the strength, energy absorption capacity and accumulated damage responses of the column under biaxial deformations as compared to the corresponding response under uniaxial deformations. Dissert. Abstr.

N79-28608 California Univ., Berkeley.
REINFORCED CONCRETE DUCTILE FRAMES UNDER EARTHQUAKE LOADINGS WITH STIFFNESS DEGRADATION Ph.D. Thesis
David Soleimani 1978 533 p
Avail: Univ. Microfilms Order No. 7914772

An extensive experimental and analytical research program for the inelastic response evaluation of ductile moment-resisting reinforced concrete multistory frame structures under strong earthquake motions is described. A twenty-story, four-bay frame, representing a typical office building, was designed. The influence of column axial deformations, flexural stiffness variations, and shear deformations on the static elastic analysis of the frame were examined. The analytical aspect of the research was primarily concerned with formulation of a reasonably accurate model, namely ZAP. The ZAP model was utilized in development of two computer programs suitable for analysis of frame structures with inelastic beam members and elastic columns except for the yielding permitted at the frame base. Dissert. Abstr.

N79-28609 California Univ., Berkeley.
THE DEVELOPMENT OF A MATHEMATICAL MODEL TO PREDICT THE FLEXURAL RESPONSE OF REINFORCED CONCRETE BEAMS TO CYCLIC LOADS, USING SYSTEM IDENTIFICATION Ph.D. Thesis
John Francis Stanton 1978 191 p
Avail: Univ. Microfilms Order No. 7914779

The experimental results to which the model was fitted were taken from a previous study in which a number of cantilever beams were subjected to cyclic lateral loads. Beams of several different geometries were tested, allowing the model to be appraised in a variety of configurations. Dissert. Abstr.

N79-28610 California Univ., Berkeley.
LARGE-DEFORMATION FORMULATION FOR SHELL ANALYSIS BY THE FINITE ELEMENT METHOD Ph.D. Thesis
Worsak Kanoknukulchai 1978 147 p
Avail: Univ. Microfilms Order No. 7914654

The development of a model for the shell started from the three dimensional field equations of continuum mechanics instead of from a particular shell theory. In order to permit solutions of shell problems without numerical difficulties, a special discretization in the thickness direction was employed: The assumption that initially straight normal lines remain straight throughout the deformation was introduced; each lamina was assumed to be in a state of plane stress; and the displacement field was represented by displacement at the reference surface together with relative displacement at the shell top surface. A total Lagrangian formulation was employed with respect to a local set of material (referential) coordinates at the element center. A consistent linearization of the discretized balance equations was used to establish a Newton-Raphson solution algorithm. Dissert. Abstr.

N79-28611*# National Aeronautics and Space Administration, Washington, D. C.
THE NASTRAN DEMONSTRATION PROGRAM MANUAL (LEVEL 16.0)
Mar. 1976 259 p refs
(NASA-SP-224(03)) Avail: NTIS HC A12/MF A01 CSCL 20K

The types of problems that can be solved with NASTRAN are presented. The nature of the problem, the underlying theory, the specific geometric and physical input quanties, and the

comparison of theoretical and NASTRAN results are discussed. At least one problem for each of the rigid formats and nearly all of the elements or provided. The features of NASTRAN demonstrated by specific problems are described. The results obtained are valid. S.E.S.

N79-28612# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

APPLICATIONS OF THE UNIFORM THEORY OF KOUYOUMJIAN-PATHAK ON THE STUDY OF DIFFRACTION OF CYLINDRICAL SHIELDS [APLICACAO DA TEORIA UNIFORME DE KOUYOUMJIAN-PATHAK NO ESTUDO DE DIFRACAO DE BLINDAGENS CILINDRICAS]

Benjamim daSilvaMedeirosCorreiaGalvao Jan. 1979 109 p refs In PORTUGUESE; ENGLISH summary

(INPE-1416-TDL/001) Avail: NTIS HC A06/MF A01

The application of the uniform theory of diffraction of Kouyoumjian - Pathak to the specific problem of a vertical short electric dipole along the axis of a finite, perfectly conducting cylindrical shielding is discussed. A presentation of the theory is made, emphasizing the derivation of the scalar diffraction coefficients. The numerical results are analyzed in the transition regions of the shadow and reflection boundaries, and compared with those obtained by the integral equation method and by the geometrical theory of diffraction. Some comments concerning the validity and limitations of the theory are presented. M.M.M.

N79-28613*# National Aeronautics and Space Administration, Washington, D. C.

POSSIBILITIES AND LIMITATIONS OF ROD-BEAM THEORIES

D. Peterson Jul. 1979 38 p refs Transl. into ENGLISH of "Moeglichkeiten und Grenzen der Stabtheorien", DFVLR-FB-78-13 DFVLR, Brunswick, 1978 p 1-41 Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(Contract NASw-3199)

(NASA-TM-75466; DFVLR-FB-78-13) Avail: NTIS HC A03/MF A01 CSCL 20K

Rod-beam theories are founded on hypotheses such as Bernouilli's suggesting flat cross-sections under deformation. These assumptions, which make rod-beam theories possible, also limit the accuracy of their analysis. It is shown that from a certain order upward terms of geometrically nonlinear deformations contradict the rod-beam hypotheses. Consistent application of differential geometry calculus also reveals differences from existing rod theories of higher order. These differences are explained by simple examples. Author

N79-28614*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

A METHOD FOR OBTAINING PRACTICAL FLUTTER-SUPPRESSION CONTROL LAWS USING RESULTS OF OPTIMAL CONTROL THEORY

Jerry R. Newson Aug. 1979 34 p refs

(NASA-TP-1471; L-12728) Avail: NTIS HC A03/MF A01 CSCL 20K

The results of optimal control theory are used to synthesize a feedback filter. The feedback filter is used to force the output of the filtered frequency response to match that of a desired optimal frequency response over a finite frequency range. This matching is accomplished by employing a nonlinear programing algorithm to search for the coefficients of the feedback filter that minimize the error between the optimal frequency response and the filtered frequency response. The method is applied to the synthesis of an active flutter-suppression control law for an aeroelastic wind-tunnel model. It is shown that the resulting control law suppresses flutter over a wide range of subsonic Mach numbers. This is a promising method for synthesizing practical control laws using the results of optimal control theory. A.R.H.

N79-28615# Washington Univ., Seattle. Dept. of Mechanical Engineering.

DYNAMIC ANALYSES OF HOMALITE-100 AND POLYCARBONATE MODIFIED COMPACT-TENSION SPECIMENS

A. S. Kobayashi, K. Seo, J. Y. Jou, and Y. Urabe Mar. 1979 31 p refs

(Contract N00014-76-C-0060)

(AD-A068184; TR-35) Avail: NTIS HC A03/MF A01 CSCL 11/6

The fracture dynamic and crack arrest responses of modified compact tension specimen (M-CT) machined from Homalite-100 and polycarbonate sheets were studied by dynamic photoelasticity, dynamic finite element analysis and streaking photography. In contrast to the results of a previous study involving a mild steel M-CT specimen, substantial dynamic effects were observed during crack propagation in the Homalite-100 and polycarbonate M-CT specimens. Although the crack arrest toughnesses, K sub Ia were within 10 percent of the corresponding static stress intensity factor at crack arrest, their values were about 80 percent and 50 percent of the corresponding fracture toughness, K sub IC of Homalite-100 and polycarbonate, respectively. GRA

N79-28616# Washington Univ., Seattle. Dept. of Mechanical Engineering.

INFLUENCE OF DYNAMIC FRACTURE TOUGHNESS ON DYNAMIC CRACK PROPAGATION

L. Hodulak, A. S. Kobayashi, and A. F. Emery Mar. 1978 25 p

(Contract N00014-76-C-0060; NR Proj. 064-478)

(AD-A068166; TR-36) Avail: NTIS HC A02/MF A01 CSCL 20/11

A dynamic finite element code was used in its 'propagation mode' to assess the differences in dynamic crack propagation in a wedge-loaded (WL) single-edged notch (SEN) specimen, a tapered double cantilever beam (TDCB) specimen and a rectangular double cantilever beam (RDCB) specimen. The dynamic fracture toughness, K(ID), versus the crack velocity, (a), relations determined experimentally for WL-SEN, WL-TDCB and WL-RDCB specimens machined from Araldite B were used as dynamic fracture criteria and the resultant K(ID) variations with crack propagations in the three specimens were compared with the corresponding experimental results. While the specific K(ID) versus (a) relations established for each specimen obviously yielded calculated K(ID) which were in best agreement with the experimental K(ID) for the respective specimen, the K(ID) versus (a) relations for the large WL-SEN specimen provided the best overall fit between the calculated and measured K(ID) variations with crack propagation in all three specimens. GRA

N79-28617# Naval Research Lab., Washington, D. C.

DYNAMIC ELASTO-PLASTIC ANALYSIS OF A SIMPLE SYSTEM Progress Report, Oct. 1977 - Sep. 1978

George J. OHara and Robert L. Bort Aug. 1978 35 p ref (SF43451594)

(AD-A068469; AD-E000241; NRL-MR-3838) Avail: NTIS HC A03/MF A01 CSCL 20/11

Six design categories were applied to design a three-bar structure connecting two rigid masses. The structure was taken as redundant, made of an elasto-plastic material, and required to resist dynamic loads applied independently from two directions. Weight and deformations of the structures are compared. Two of the categories allow significant reduction in the weight of the structure without producing excessive deformation. GRA

N79-28618# Illinois Inst. of Tech., Chicago. Dept. of Mathematics.

EXAMPLES OF RATE-THEORY CONSTITUTIVE EQUATIONS WHICH UNIFY ELASTICITY AND PLASTICITY

Barry Bernstein Jan. 1979 32 p refs

(Contract DAAG29-76-D-0100)

(AD-A068467; AD-E430205; ARBRL-CR-00389) Avail: NTIS HC A03/MF A01 CSCL 20/11

Examples of rate theory types of constitutive relations are developed which allow as solutions both elastic and plastic stress-strain relations. Elastic behavior is associated with uniqueness of solutions and plastic behavior with non-uniqueness of solutions of ordinary differential equations. Transition from one elastic solution to another elastic solution through a plastic solution allows the description both of loading and unloading by the same set of constitutive differential equations. GRA

N79-28619# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.

A VARIABLE-STEP CENTRAL DIFFERENCE METHOD FOR STRUCTURAL DYNAMICS ANALYSIS. PART 1: THEORETI-

CAL ASPECTS. PART 2: IMPLEMENTATION AND PERFORMANCE EVALUATION
K. C. Park and P. G. Underwood Apr. 1979 24 p refs
(Contract N00014-74-C-0355)
(AD-A068598; LMSC-D626886-Pt-1; LMSC-D626886-Pt-2; LMSC-D633782-Pt-1; LMSC-D633782-Pt-2) Avail: NTIS HC A02/MF A01 CSCL 20/11

Part I: Three major theoretical aspects of variable-step explicit integration procedures are proposed and analyzed. These include basic fixed-step integration formulas for no damping, diagonal damping and nondiagonal damping problems; the adjustment of the basic formulas to accommodate step changes; and, step size selection criteria. It is shown that the truncation error concept is not adequate to detect numerical instability for general structural dynamics analysis when low accuracy is requested. The 'apparent frequency' concept is introduced to maximize stable step sizes and is shown to be stable when low accuracy is requested. Part II: The variable-step central difference method developed in Part I is implemented as a stand-alone software package that is easily accessed by existing structural dynamics analyzers (i.e., finite-element, -difference discrete element computer codes) through a common data structure, input/output (I/O) manager and a few user-supplied control and interface routines. The performance of this package is evaluated through a computer study of four sample problems that embody a large class of response characteristics: linear to highly nonlinear; wave to structural to uncoupled component response; narrow to wide frequency spread; no damping to over-damping and accuracy-critical to numerical-stability-critical response. The present method is successful in meeting these response characteristics with effectiveness in all the above cases with the single exception of pure wave propagation. GRA

N79-28620# Lockheed-Georgia Co., Marietta.
INVESTIGATION OF STRESS-STRAIN HISTORY MODELING AT STRESS RISERS, PHASE 2 Final Report, 15 Feb. 1977 - 30 Sep. 1978
James R. Carroll, R. L. Brugh, and W. Wilkinson Dec. 1978 261 p refs
(Contract F33615-75-C-3078)
(AD-A069162; LG78ER240; AFFDL-TR-78-167) Avail: NTIS HC A12/MF A01 CSCL 01/3

An analytical and experimental study of the stress and strain history at stress risers was conducted to evaluate the effects of time- and cycle-dependent changes on the fatigue life of aluminum alloy structures. This report covers Phase II of a two-phase program. Both creep and stress relaxation were modeled and measured. An elastic-plastic finite element code simulation was utilized to model the nonlinear stress-strain field around the stress riser and to model creep sustained load hold periods. A four-part experimental program was conducted to generate constitutive data necessary for the formulation of a hysteresis analysis model. The experimental program included simple coupon specimens, a unique simplified stress concentration specimen, center circularly notched super-scale specimens, and notched fatigue specimens. Significant creep and stress relaxation was measured during the experimental program. These data were used in the development of a creep/stress relaxation module for the hysteresis analysis. The automated hysteresis analysis developed during this program includes a material hardening/softening module, a creep/stress relaxation module, locus and branch curve definition for the stable material response, and a damage accumulation module. Correlation studies have been conducted using this analysis as well as a linear damage analysis method to compare predicted versus actual specimen life. GRA

N79-28621# State Univ. of New York, Stony Brook. Dept. of Materials Science.
APPLICATION OF MICRODYNAMICS AND LATTICE MECHANICS TO PROBLEMS IN PLASTIC FLOW AND FRACTURE Final Report, 1 Apr. 1973 - 31 Mar. 1978
J. C. Bilello and J. M. Liu 21 Jun. 1978 15 p refs
(Contract EY-76-S-02-3476)
(COO-3476-16) Avail: NTIS HC A02/MF A01

The research program consisted of both theoretical formulations and experimental measurements of a number of intrinsic material parameters in bcc metals and alloys including surface energy, phonon-dispersion curves for dislocated solids, dislocation-point defect interaction energy, slip initiation and microplastic flow behavior. The study resulted in an improved understanding in the relationship among the experimentally determined fracture surface energy, the intrinsic cohesive energy between atomic planes, and the plastic deformation associated with the initial stages of crack progagation. The values of intrinsic surface energy of tungsten, molybdenum, niobium and niobium-molybdenum alloys, deduced from the measurements, serve as a starting point from which fracture toughness of these materials in engineering service may be intelligently discussed. DOE

N79-28622# Oak Ridge National Lab., Tenn.
NOTCH EFFECTS IN UNIAXIAL TENSION SPECIMENS
T. J. Delph Mar. 1979 21 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6716) Avail: NTIS HC A02/MF A01

Results of a literature survey on the effect of notches on the time-dependent failure of uniaxial tension specimens at elevated temperatures are presented. Particular attention is paid to the failure of notched specimens containing weldments. DOE

N79-28623# Maryland Univ., College Park. Dept. of Mechanical Engineering.
PHOTOELASTIC STUDIES OF CRACK PROPAGATION AND ARREST IN POLYMERS AND 4340 STEEL
G. R. Irwin, W. L. Fourney, T. Kobayashi, J. T. Metcalf, and J. W. Dally Nov. 1978 326 p refs
(Contract NRC-94-76-172)
(NUREG/CR-0542) Avail: NTIS HC A15/MF A01

Progress is reported concerning the further evaluation of proposed standard procedures for determining arrest toughness; study of crack behavior of 4340 steel with firefringent coatings; comparison of crack behavior in plastic and steel duplex specimen; a dynamic photoelastic study of crack propagation in a ring specimen; characterization of effect of damping on crack behavior; comparison of crack behavior in Araldite B and Homalite 100; and parametric aspects of crack tip stress fields. DOE

N79-28624# Knolls Atomic Power Lab., Schenectady, N. Y.
GENERALIZED FRACTURE TOUGHNESS OF BRITTLE MATERIALS
G. DiLeonardo Jan. 1979 20 p refs
(Contract EY-76-C-12-0052)
(KAPL-4110) Avail: NTIS HC A02/MF A01

A generalization of fracture toughness of brittle materials, when subjected to multiaxial loadings, is presented. The theory characterizes the fracture strength of structural materials under any combination of the three basic modes of crack surfaces displacement. The most general fracture mechanism is the result of the combination of the opening mode of the tangential stress component and the tearing mode of the antiplane shear. A simple fracture criterion permits forcasting crack propagation for any combination of loads and geometries. DOE

N79-28625# Central Electricity Research Labs., Leatherhead (England).
FRACTURE TOUGHNESS AND SLOW CRACK GROWTH IN AUSTENITIC STAINLESS STEELS AND WELDMENTS
J. R. Haigh 14 Sep. 1978 30 p
(CEGB/LM/MATS-220) Avail: NTIS HC A03/MF A01

Fracture of notched and cracked sections of austenitic stainless steels and weldments was reviewed. Temperatures up to and including the creep range were included. Emphasis was placed on ductilities rather than strengths to help solution of problems in defect assessment caused by residual stresses. The lowest ductilities occurred in the creep range in as-welded filler metals exposed for extended periods. Comparisons with some ferritic steels which generally perform well show that brittle fracture of austenitics is unlikely in service conditions. The comparisons become particularly favorable with stress relief heat treatments. DOE

N79-28626# California Univ., Livermore. Lawrence Livermore Lab.
EXPERIMENTAL AND COMPUTER-SIMULATION STUDY OF HIGH-VELOCITY IMPACT DEFORMATION IN PREHEATED MATERIALS

W. H. Gust, D. A. Young, and J. K. Scudder 12 Dec. 1978 20 p refs
(Contract W-7405-eng-48)
(UCRL-52621) Avail: NTIS HC A02/MF A01

A reverse gun technique for studying high-strain-rate deformations in preheated materials was developed. In this procedure, a rigid plate is fired at a stationary heated cylindrical rod; in contrast, the standard rifle procedure fires an unheated rod into a stationary plate. The advantage of the reverse gun method is that the rod can be preheated and the temperature monitored. The technique was validated by comparing both methods in experiments conducted at room temperature, deformation data for aluminum and copper rods heated to 725 K were obtained. Good agreement was observed between the measured shape of the recovered rods and the shapes generated by hydrodynamic code calculations. DOE

N79-28627# Brookhaven National Lab., Upton, N. Y.
HIGH CYCLE FATIGUE OF TYPE 422 STAINLESS STEEL
Peter Soo, J. G. Y. Chow, and R. L. Sabatini 1978 13 p ref Presented at the 2d US-Japan Sem. on HTGR Safety Technol., Fuji, Japan, 24 Nov. 1978
(Contract EY-76-C-02-0016)
(BNL-NUREG-25332; Conf-781144-12) Avail: NTIS HC A02/MF A01

High cycle fatigue testings were carried out on Type 422 stainless steel to determine the performance of cyclically stressed disks and blades in the main and auxiliary HTGR helium circulators. Tests were performed at 316, 482, and 538 C (600, 900, and 1000 F) in air for the fully reversible and mean load conditions. Goodman's analysis is shown to be valid in predicting failure at 316 C (600 F), marginally valid at 482 C (900 F), and probably invalid at 538 C (1000 F). Metallographic analyses were conducted to characterize the nature of failure for the temperatures and loading conditions investigated. DOE

N79-28628# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
STRESS INTENSITY DISTRIBUTION IN NOZZLE CORNER CRACKS OF COMPLEX GEOMETRY
C. W. Smith, W. H. Peters, W. T. Hardrath, and T. S. Fleischman Jan. 1979 44 p refs
(Contract W-7405-eng-26)
(NUREG/CR-0640; ORNL/SUB-7015-2; VPI-79-2) Avail: NTIS HC A03/MF A01

A series of frozen stress photoelastic experiments were conducted on scale models of boiling water reactor vessels each containing two diametrically opposite cracked nozzles with cracks oriented at 0, 45, or 90 degrees to the plane on which the vessel hoop stress acted. A range of flaw sizes were studied and cracks were extended by internal pressure loading. Flaw shapes and stress intensity factor (SIF) distributions were obtained and average values of the latter were compared with analytical results. It was concluded that: flaw growth is nonself-similar and SIF distributions are sensitive to flaw shapes. When loaded by shear modes, flaws reorient themselves often forming nonplanar cracks so as to eliminate the shear mode. Quantitative flaw shapes and SIF distributions are provided. DOE

N79-28629# Massachusetts Inst. of Tech., Cambridge. Constructed Facilities Div.
VERTICAL AND TORSIONAL STIFFNESS OF CYLINDRICAL FOOTINGS
E. Kausel and R. Ushijima Feb. 1979 73 p refs
(Grant NSF ENV-77-18339)
(PB-293997/3; R79-6) Avail: NTIS HC A04/MF A01 CSCL 13M

A numerical evaluation of the vertical and torsional stiffnesses of a cylindrical foundation embedded in an elastic stratum is presented. Empirical formulas are given that relate stiffnesses and damping values with the embedment ratio and the depth of the stratum. Good agreement is found between the reported approximations and available analytical solutions for particular geometries. GRA

N79-28630# Weidlinger Associates, New York.
AXIAL VIBRATIONS OF A FLUID FILLED PIPE
Ivan Nelson Nov. 1978 41 p refs
(Grant NSF PFR-78-15049)
(PB-293838/9; NSF/RA-780463; TN-1) Avail: NTIS HC A03/MF A01 CSCL 13K

Fluid pipe interaction was studied when the only mechanism for coupling is the fluid viscosity. Problem formulation, vanishingly small frequencies, and high frequency response were investigated. It is concluded that for any practical range of parameters, the effect of an internal fluid, coupled to a pipe through viscosity only, on the longitudinal (axial) vibrations of the pipe is negligible. GRA

N79-28368 Kaman Aerospace Corp., Bloomfield, Conn.
PARAMETER IDENTIFICATION TECHNIQUES FOR VIBRATING STRUCTURES
A. Berman *In* Shock and Vibration Inform. Center Shock and Vibration Dig., Vol. 11, No. 1 Jan. 1979 p 13-24 refs (For primary document see N79-28366 19-31)
Avail: SVIC, Code 8404, Naval Research Laboratory, Washington, D. C. 20375; $15.00/set

N79-28369 Oklahoma Univ., Norman. School of Aerospace, Mechanical and Nuclear Engineering.
FINITE ELEMENT MODELING OF STRUCTURAL VIBRATIONS: A REVIEW OF RECENT ADVANCES
J. N. Reddy *In* Shock and Vibration Inform. Center Shock and Vibration Dig., Vol. 11, No. 1 Jan. 1979 p 25-39 refs (For primary document see N79-28366 19-31)
Avail: SVIC, Code 8404, Naval Research Laboratory, Washington, D. C. 20375; $15.00/set

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography*.

N79-28631 California Univ., Berkeley.
LANDSLIDE SUSCEPTIBILITY EVALUATION IN THE SANTA CRUZ RANGE, SAN MATEO COUNTY, CALIFORNIA Ph.D. Thesis
Gerald Francis Wieczorek 1978 223 p
Avail: Univ. Microfilms Order No. 7914838

A regional assessment of landslide susceptibility is of increasing importance as development proceeds beyond the margins of San Franscisco Bay into the surrounding mountainous areas. An area in the Santa Cruz Range of San Mateo County, near the town of La Honda, was selected for a variety of field, laboratory and airphoto investigations to assess the present stability of slopes and to develop empirical criteria by which other slopes in the San Francisco Bay region could be evaluated. An inventory of landslides in the La Honda field area was prepared from a stereoscopic study of aerial photographs of several different scales and ages. Subsequent field checking and drilling of some of the landslides established the general validity of the landslide inventory. Landslides were categorized on the basis of current activity, type of movement, reliability of identification and depth of material involved in landsliding. Dissert. Abstr.

N79-28632 Purdue Univ., Lafayette, Ind.
THE PROJECTION METHOD IN IMAGE RESTORATION Ph.D. Thesis
Stephen Paul Berger 1978 143 p
Avail: Univ. Microfilms Order No. 7914874

The linear degradation of a two-dimensional image can be represented by a system of linear equations. The solution to the

equations represents the restored image. For most image processing problems, the resultant degradation matrix is extremely large and sparse. The standard elimination or relaxation procedures are impractical for such systems. The projection method is an iterative technique which is well-suited to the solution of the image restoration problem. The projection method has several qualities which make it desirable. The algorithm always converges. The technique can be used to restore spatially variant as well as invariant degradations. The projection method is capable of incorporating a priori information. The method was used to restore actual satellite data with an assumed Gaussian shaped degradation. The behavior of the method was shown to be very similar to inverse filtering techniques. Dissert. Abstr.

N79-28633*# Auburn Univ., Ala. Cooperative Extension Service.
DETECTION OF PLANT STRESS THROUGH MULTISPECTRAL PHOTOGRAPHY Final Report
T. B. Hagler and Sanford W. Downs, Jr., Principal Investigators (NASA. Marshall Space Flight Center) [1979] 13 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Contract NAS8-29856)
(E79-10083; NASA-CR-161242; Circular-ANR-72) Avail: NTIS HC A02/MF A01 CSCL 14E
There are no author-identified significant results in this report.

N79-28634*# Environmental Research and Technology, Inc., Concord, Mass.
INVESTIGATION OF THE APPLICATION OF HCMM THERMAL DATA TO SNOW HYDROLOGY Quarterly Progress Report, Apr. - Jun. 1979
James C. Barnes, Principal Investigator 6 Jul. 1979 5 p ERTS
(Contract NAS5-24316)
(E79-10213; NASA-CR-158685; QPR-7) Avail: NTIS HC A02/MF A01 CSCL 08L
There are no author-identified significant results in this report.

N79-28635*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
UNIFORM COLOR SPACE ANALYSIS OF LACIE IMAGE PRODUCTS Progress Report, 15 Nov. 1977 - 14 Jun. 1978
Richard F. Nalepka, Principal Investigator, R. J. Balon, and R. C. Cicone May 1979 144 p refs Sponsored by NASA, NOAA, and USDA EREP
(Contract NAS9-15476)
(E79-10221; NASA-CR-160236; ERIM-132400-10-R) Avail: NTIS HC A07/MF A01 CSCL 02C
The author has identified the following significant results. Analysis and comparison of image products generated by different algorithms show that the scaling and biasing of data channels for control of PFC primaries lead to loss of information (in a probability-of misclassification sense) by two major processes. In order of importance they are: neglecting the input of one channel of data in any one image, and failing to provide sufficient color resolution of the data. The scaling and biasing approach tends to distort distance relationships in data space and provides less than desirable resolution when the data variation is typical of a developed, nonhazy agricultural scene.

N79-28636*# Lunar and Planetary Inst., Houston, Tex.
WORKSHOP ON REMOTE SENSING OF VOLCANIC GASES: CURRENT STATUS AND FUTURE DIRECTIONS
Tom McGretchin and Tom McCord, Principal Investigators (Univ. of Hawaii, Honolulu) 1979 53 p refs Workshop held at Honolulu, Hawaii, 26-27 Feb. 1979 ERTS
(Contract NSR-09-051-001)
(E79-10222; NASA-CR-158748; LPI-Contrib-368) Avail: NTIS HC A04/MF A01 CSCL 08K
There are no author-identified significant results in this report.

N79-28637*# Geological Survey, Menlo Park, Calif.
DETECTION AND MAPPING OF HYDROTHERMALLY ALTERED ROCKS IN THE VICINITY OF THE COMSTOCK LODE, VIRGINIA RANGE, NEVADA, USING ENHANCED LANDSAT IMAGES
R. P. Ashley, Principal Investigator, A. F. H. Goetz (JPL), L. C. Rowan (Geological Survey, Reston, Va.), and M. J. Abrams (JPL) 1979 46 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E79-10223; NASA-CR-158749; Rept-79-960) Avail: NTIS HC A03/MF A01 CSCL 08G
The author has identified the following significant results. LANDSAT images enhanced by the band-ratioing method can be used for reconnaissance alteration mapping in moderately heavily vegetated semiarid terrain as well as in sparsely vegetated to semiarid terrain where the technique was originally developed. Significant vegetation cover in a scene, however, requires the use of MSS ratios 4/5, 4/6, and 6/7 rather than 4/5, 5/6, and 6/7, and requires careful interpretation of the results. Supplemental information suitable to vegetation identification and cover estimates, such as standard LANDSAT false-color composites and low altitude aerial photographs of selected areas is desirable.

N79-28638*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
RESEARCH IN REMOTE SENSING OF AGRICULTURE, EARTH RESOURCES, AND MAN'S ENVIRONMENT Quarterly Report, 1 Mar. - 31 May 1979
D. A. Landgrebe, Principal Investigator 31 May 1979 110 p refs EREP
(Contract NAS9-15466)
(E79-10224; NASA-CR-160241; LARS-CR-053179) Avail: NTIS HC A06/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N79-28639*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). FURTHER EVALUATION OF PROCEDURE 1 SECONDARY ERROR ANALYSIS
K. A. Havens, Principal Investigator May 1979 43 p refs Sponsored by NASA, NOAA, and USDA EREP
(Contract NAS9-15800)
(E79-10225; NASA-CR-160238; JSC-14746; LEC-13180) Avail: NTIS HC A03/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N79-28640*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
NATIONWIDE FORESTRY APPLICATIONS PROGRAM. EVALUATION PROCESS FOR THE TEN-ECOSYSTEM STUDY
R. H. Almond, Principal Investigator Apr. 1979 62 p refs Sponsored in part by US Forest Service EREP
(Contract NAS9-15800)
(E79-10226; NASA-CR-160243; LEC-12727; JSC-14872) Avail: NTIS HC A04/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N79-28641*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). EXAMPLES OF PHASE 3 OMISSION LABELING ERRORS
N. James Clinton, Principal Investigator May 1979 15 p ref Sponsored by NASA, NOAA, and USDA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-15800)
(E79-10227; NASA-CR-160237; JSC-14837; LEC-13198) Avail: NTIS HC A02/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N79-28642*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.

ACCEPTANCE TEST SPECIFICATIONS OF THE LANDSAT IMAGERY VERIFICATION AND EXTRACTION SYSTEM (LIVES)

J. M. Everette, Principal Investigator Mar. 1979 46 p refs EREP

(Contract NAS9-15800)

(E79-10228; NASA-CR-160246; LEC-12900; JSC-14635) Avail: NTIS HC A03/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N79-28643*# Humboldt State Univ., Arcata, Calif. Center for Community Development.

DEVELOPING AND DEMONSTRATING AN INSTITUTIONAL MECHANISM FOR TRANSFERRING REMOTE SENSING TECHNOLOGY TO 14 WESTERN STATES USING NORTHERN CALIFORNIA AS THE TEST SITE Final Report, 1 Jun. 1977 - 31 Dec. 1978

Donna Hankins, Principal Investigator 31 Dec. 1978 622 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS

(Grant NsG-2244)

(E79-10229; NASA-CR-158758; Rept-3) Avail: NTIS HC A99/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N79-28644*# Ohio State Univ., Columbus. Dept. of Geodetic Science.

GLOBAL ACCURACY ESTIMATES OF POINT AND MEAN UNDULATION DIFFERENCES OBTAINED FROM GRAVITY DISTURBANCES, GRAVITY ANOMALIES AND POTENTIAL COEFFICIENTS

Christopher Jekeli [1979] 46 p refs

(Grant NGR-36-008-161)

(NASA-CR-158836; Rept-288) Avail: NTIS HC A03/MF A01 CSCL 08E

Through the method of truncation functions, the oceanic geoid undulation is divided into two constituents: an inner zone contribution expressed as an integral of surface gravity disturbances over a spherical cap; and an outer zone contribution derived from a finite set of potential harmonic coefficients. Global, average error estimates are formulated for undulation differences, thereby providing accuracies for a relative geoid. The error analysis focuses on the outer zone contribution for which the potential coefficient errors are modeled. The method of computing undulations based on gravity disturbance data for the inner zone is compared to the similar, conventional method which presupposes gravity anomaly data within this zone. Author

N79-28645*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

SEASAT-A SATELLITE SCATTEROMETER MISSION SUMMARY AND ENGINEERING ASSESSMENT REPORT

James W. Johnson, Wendell H. Lee, and Leon A. Williams May 1979 146 p

(NASA-TM-80122) Avail: NTIS HC A07/MF A01 CSCL 08C

The SeaSat-A satellite was launched on June 26, 1978 and operated in orbit through October 9, 1978. The SeaSat-A satellite scatterometer ocean surface wind field sensor began taking data on July 10, 1978 with virtually continuous operation for 95-1/2 days. A review of mission events significant to the scatterometer and a report on the hardware and software engineering assessment are presented. G.Y.

N79-28646*# Ohio State Univ. Research Foundation, Columbus. Dept. of Geodetic Science.

SATELLITE TRIANGULATION IN EUROPE FROM WEST AND ISAGEX DATA

Alfred Leick and Manohar Arur Nov. 1975 116 p refs

(Grant NGR-36-008-093)

(NASA-CR-158835; Rept-232) Avail: NTIS HC A06/MF A01 CSCL 08E

Observational data that was acquired during the West European Satellite Triangulation (WEST) program and the International Satellite Geodesy Experiment (ISAGEX) campaign was obtained for the purpose of performing a geometric solution to improve the present values of coordinates of the European stations in the OSU WN14 solutions, adding some new stations and assessing the quality of the WN14 solution with the help of the additional data available. The status of the data as received, the preprocessing required and the preliminary tests carried out for the initial screening of the data are described. The adjustment computations carried out and the results of the adjustments are discussed. A.R.H.

N79-28647*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ASSESSING SOYBEAN LEAF AREA AND LEAF BIOMASS BY SPECTRAL MEASUREMENTS

Brent N. Holben, Compton J. Tucker, and Cheng-jing Fan Jul. 1979 22 p refs Submitted for publication

(NASA-TM-80312) Avail: NTIS HC A02/MF A01 CSCL 02C

Red and photographic infrared spectral radiances were correlated with soybean total leaf area index, green leaf area index, chlorotic leaf area index, green leaf biomass, chlorotic leaf biomass, and total biomass. The most significant correlations were found to exist between the IR/red radiance ratio data and green leaf area index and/or green leaf biomass (r squared equals 0.85 and 0.86, respectively). These findings demonstrate that remote sensing data can supply information basic to soybean canopy growth, development, and status by nondestructive determination of the green leaf area or green leaf biomass. J.M.S.

N79-28648*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

EVALUATION AND MODELING OF THE TOPOGRAPHIC EFFECT ON THE SPECTRAL RESPONSE FROM NADIR POINTING SENSORS

Brent N. Holben and Christopher O. Justice Jun. 1979 24 p refs Submitted for publication

(NASA-TM-80305) Avail: NTIS HC A02/MF A01 CSCL 05B

A field experiment, using a hand-held radiometer, was designed and conducted to assess a simple theoretical incidence model for simulating the topographic effect of a uniform sand surface. Seven data sets were taken to compare effects of solar elevation and azimuth encountered at different times of year. Analysis of these data showed considerable variation in radiance values for different slope angles and aspects and that these values varied considerably with changes in solar elevation and azimuth. The field measured variations in spectral response were found to have generally strong correlations with the theoretical model. The reason for the occurrence of lower correlations are given and methods for improving the model are suggested. A model to simulate LANDSAT sensor response was applied to two subsets of the field data to establish the magnitude of the topographic effect on satellite data. Author

N79-28649*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

PASSIVE MICROWAVE APPLICATIONS TO SNOWPACK MONITORING USING SATELLITE DATA

Dorothy K. Hall, James L. Foster, Alfred T. C. Chang, and Albert Rango Jun. 1979 15 p refs Submitted for publication

(NASA-TM-80310) Avail: NTIS HC A02/MF A01 CSCL 08L

Nimbus-5 Electrically Scanned Microwave Radiometer data were analyzed for the fall of 1975 and winter and summer of 1976 over the Arctic Coastal Plain of Alaska to determine the applicability of those data to snowpack monitoring. It was found that when the snow depth remained constant at 12.7 cm, the brightness temperatures T sub B varied with air temperature. During April and May the production of ice lenses and layers within the snow, and possibly wet ground beneath the snow contribute to the T sub B variations also. Comparison of March T sub B values of three areas with the same (12.7 cm) snow depth showed that air temperature is the predominant factor controlling the T sub B differences among the three areas, but

underlying surface conditions and individual snowpack characteristics are also significant factors. Author

N79-28650# Army Construction Engineering Research Lab., Champaign, Ill.

GRAPHIC MATERIALS TO SUPPORT BIOPHYSICAL QUANTITATIVE ENVIRONMENTAL IMPACT ANALYSIS: SOURCES OF EXISTING MATERIALS Final Report

W. D. Goran and R. E. Riggins Mar. 1979 83 p refs
(DA Proj. 4A7-62720-A-896)
(AD-A069097; CERL-TR-N-68) Avail: NTIS HC A05/MF A01 CSCL 08/2

This report identifies and describes resource materials (maps and imagery) currently available for environmental impact analysis on U.S. Army military installations. Only materials that relate to the biophysical and land use elements of the environment are considered. The report describes procedures for obtaining these materials and lists specific materials relevant to major U.S. Army military installations. This report also provides some tables, formulas, and procedures for quantitatively analyzing these graphical representations of environmental information. Author (GRA)

N79-28651# Perceptronics, Inc., Woodland Hills, Calif.

MAPS: A GUIDE TO INNOVATIVE DESIGN

Gershon Weltman Feb. 1979 254 p refs
(Contract MDA903-76-C-0241; ARPA Order 3200)
(AD-A069153; PTR-1033S-78-1) Avail: NTIS MF A01; Perceptronics, Inc., 6271 Variel Ave., Woodland Hills, Calif. 91367 HC $15.00 CSCL 08/2

This report is directed toward the designers and users of maps. Its purpose is to facilitate innovation in these functions by: (1) establishing a psychological model of the mapping process, (2) presenting outstanding examples of map designs, and (3) considering implications of computer technology for the production of new and improved maps. Each of these topics forms a separate chapter. The chapter on map examples contains about 160 modern and historical maps, illustrated and briefly described. GRA

N79-28652# Department of Energy, Washington, D. C. Energy Information Administration.

FACTORS AFFECTING THE DECLINE RATE OF OLD OIL PRODUCTION

Charles G. Everett Dec. 1978 27 p refs
(DOE/EIA-0102/29) Avail: NTIS HC A03/MF A01

Data on old oil production over the period January 1975 to March 1978 were analyzed. It is concluded that the rapid decline in reported values of Lower Tier Oil was effected by changes in the regulatory definition of Lower Tier Oil, in addition to the normal decline which would have obtained under regulatory stability. By analyzing the available data the old portion of old/new properties is projected to decline at about 5.5 percent per year. If projections from the two subcategories are combined the average annual decline between 1978 and 1985 is approximately 9.1 percent, and the 1985 forecast of Lower Tier Oil production is about 1.8 million barrels per day. DOE

N79-28653# California Univ., Livermore. Lawrence Livermore Lab.

REACTION KINETICS FOR REMODELING OIL SHALE RETORTING

J. H. Campbell and A. K. Burnham Jan. 1979 51 p refs Presented at the Am. Inst. of Chem. Eng. Meeting, Houston, Tex., 1-5 Apr. 1979
(Contract W-7405-eng-48)
(UCRL-81622; Conf-790405-8) Avail: NTIS HC A04/MF A01

Results from recent laboratory kinetic studies on gasification, pyrolysis, and mineral reactions in oil shale are presented. The specific pyrolysis reactions investigated include the decomposition of kerogen, the evolution of oil, hydrogen and C2 plus C3 hydrocarbons and the formation of a carbonaceous residue. Data describing the evolution of H2 and CH4 during secondary pyrolysis of the carbonaceous residue are also presented. The mineral reaction kinetics discussed include the decomposition and/or reaction (with silica or silicates) of calcite, dolomite, dawsonite and nahcolite. Rate equations describing the effects of CO2 and steam on the reactions of calcite and dolomite are presented. Kinetics describing gasification of the carbonaceous residue by CO2 and H2O are examined. DOE

N79-28654# Lewin and Associates, Inc., Washington, D. C.

ENHANCED RECOVERY OF UNCONVENTIONAL GAS: THE METHODOLOGY, VOLUME 3

Vello A. Kuuskraa, J. P. Brashear, Todd M. Doscher (University of Southern California), and Lloyd E. Elkins Feb. 1979 407 p refs 3 Vol.
(Contract EF-77-C-01-2705)
(HCP/T-2705-03) Avail: NTIS HC A18/MF A01

The methodology is described on the analytic approach, estimated natural gas production, recovery from tight gas sands, recovery from Devonian shales, recovery from coal seams, and recovery from geopressured aquifers. Author (DOE)

N79-28655# Golder Associates, Inc., Kirkland, Wash.

PLAN TO DEMONSTRATE OIL SHALE MINING AND RUBBLIZING FOR A MODIFIED IN SITU RETORTING PROCESS

Jan. 1979 50 p
(Contract W-7405-eng-48)
(UCRL-13979) Avail: NTIS HC A03/MF A01

A proposed program for investigating the mining and rubblizing requirements for modified in-situ retorting is reported. The program includes basic blasting experiments in small scale retorts and is scoped in some detail with schedules and costs estimated fairly reliably. The program also includes application of the results obtained to a larger scale to test the mining concepts and the success of rubblization in a commercial size retort. This work is necessarily described in less detail and only approximate time and cost estimates are provided. DOE

N79-28656# California Univ., Livermore. Lawrence Livermore Lab.

MULTIPHASE FLOW ANALYSIS OF OIL SHALE RETORTING

D. Gidaspow (Illinois Inst. of Tech., Chicago) and R. W. Lyczkowski Mar. 1979 16 p refs Presented at 2d Multiphase Flow and Heat Transfer Symp. and Workshop, Miami Beach, Fla., 16-18 Apr. 1979
(Contract W-7405-eng-48)
(UCRL-81717-Rev-1; Conf-790423-4) Avail: NTIS HC A02/MF A01

Multiphase processes associated with oil shale retorting were analyzed including condensation of oil shale vapor, and pressure oscillations in oil shale blocks through cracked bedding planes. Energy conservation equations for oil shale retorting, which include the effects associated with condensation of oil, were derived on the basis of two-phase flow theory. It is suggested that an effective heat capacity associated with the latent heat of condensation should be included in the modeling of simulated modified in-situ oil shale retorting. A pressure propagation equation for fast transients in oil shale cracks was derived and examined in view of existing experimental data. For slow processes, a limiting solution for maximum pressure in oil shale rocks was obtained. DOE

N79-28657# California Univ., Livermore. Lawrence Livermore Lab.

CHALLENGE OF EFFICIENTLY RETORTING VERY NONUNIFORM BEDS OF OIL SHALE RUBBLE

T. R. Galloway 16 Mar. 1979 74 p refs Presented at AIChE Meeting, Houston, Tex., 1-5 Apr. 1979
(Contract W-7405-eng-48)
(UCRL-81721-Rev-1; Conf-790405-9) Avail: NTIS HC A04/MF A01

Recent experimental pilot scale retort work has shown significant declines in oil recovery yield as the size of the shale block increases. Current analyses of the problem were reviewed, together with experimental evidence for the key fluid mechanical, heat transfer and mass transfer processes that caused these lower yields. It was found that loss in retort oil yield was dominated by the flow patterns in the matrix material around the large blocks and by the thermal transient characteristics within the blocks. The principal mechanism appeared to be burning and cracking of the produced oil in the gas phase near the larger

shale blocks. The use of process control methods involving air/steam ratio, total flow, and flow variations coupled with monitored exit gas composition appears feasible to maximize oil production. DOE

N79-28658# California Univ., Livermore. Lawrence Livermore Lab.
MULTIPHASE FLOW ANALYSIS OF OIL SHALE RETORTING
D. Gidaspow and R. W. Lyczkowski Sep. 1978 22 p refs Presented at 2d Multiphase Flow and Heat Transfer Symp. Workshop, Miami Beach, Fla., 16 Apr. 1979
(Contract W-7405-eng-48)
(UCRL-81717; Conf-790423-2) Avail: NTIS HC A02/MF A01

Several multiphase phenomena occur during oil shale retorting. An analysis is presented of two of these processes including condensation of oil shale vapor and oscillations of pressure in oil shale blocks through cracked bedding planes. Energy conservation equations for oil shale retorting, which include the effects associated with condensation of oil, are derived on the basis of two phase flow theory. It is suggested that an effective heat capacity associated with the latent heat of condensation should be included in the modeling of simulated modified in situ oil shale retorting. A pressure propagation equation for fast transients in oil shale cracks has been derived and examined in view of existing experimental data. For slow processes, a limiting solution for maximum pressure in oil shale rocks has been obtained. Generation of high pressures in rocks by thermal or other means may lead to rock fracture which may be taken advantage of in modified in situ oil shale processing. DOE

N79-28659# Oak Ridge National Lab., Tenn.
WATER RESOURCES EVALUATION
D. J. Downing, G. W. Westley, and D. J. Pack Apr. 1979 39 p refs
(Contract W-7405-eng-26)
(ORNL/CSD/TM-86) Avail: NTIS HC A03/MF A01

Weekly river flow data is analyzed using the techniques of Box and Jenkins. Intervention analysis, first proposed by Box and Tiao, is applied where the intervening event is the creation of a dam. The idea of intervention analysis is combined with transfer function analysis to utilize rainfall data in a unique way and greatly improve the predictive ability of the model, as well as giving meaningful physical interpretations to the parameters in the model. DOE

N79-28660# Nevada Univ., Reno. Desert Research Inst.
DEVELOPMENT OF A QUASI THREE-DIMENSIONAL GROUNDWATER MODEL FOR A PORTION OF THE NEVADA TEST SITE
P. L. Oberlander Jan. 1979 89 p refs
(Contract EY-76-C-08-1253)
(NVO-1253-14) Avail: NTIS HC A05/MF A01

An empirical correction matrix was devised that partially adjusts a two dimensional model for flow in the third dimension. In an isotropic and homogeneous medium, the correction matrix averages 4.9% difference in potential values. The correction matrix was applied to the groundwater system from Pahute Mesa to Yucca Flat on the Nevada Test Site, a distance of 24 kilometers. Groundwater is recharged at Pahute Mesa and flows to Yucca Flat at the rate of 64.8 acre feet/year. The maximum water flow under all of Yucca Flat and into the Ash Meadows groundwater system is 1240 acre feet/year. DOE

N79-28661# Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
SYNTHESIS AND CALIBRATION OF A RIVER BASIN WATER MANAGEMENT MODEL
John M. Shafer and John W. Labadie Oct. 1978 76 p refs
(Contract DI-14-34-0001-8006; OWRT Proj. A-039-COLO(1))
(PB-293850/4; COMPLETION-89; W79-05583) Avail: NTIS HC A05/MF A01 CSCL 13B

A computer model is presented for the analysis of large scale water resources policy changes. The model was designed to aid in the investigation of the impact of volumetric transfers of water, on a monthly basis, throughout a system of interconnected storage and demand centers. An interactive conversational data management program was also interfaced with the model to facilitate the rapid analysis of varying management alternatives. The case study approach was used to present the model and demonstrate its application. The Cache la Poudre River Basin in north-central Colorado was modeled to determine the availability of a firm water supply. GRA

N79-28662# Texas A&M Univ., College Station. Dept. of Oceanography.
SOUTH TEXAS TOPOGRAPHIC FEATURES STUDY Final Report for 1976
Richard Rezak, Thomas J. Bright, Stefan Gartner, and Willis E. Pequegnat Sep. 1978 803 p refs
(Contract DI-AA550-CT6-18)
(PB-294768/7; BLM/YM/ES-78/03) Avail: NTIS HC A99/MF A01 CSCL 08J

Texas A and M University and the Texas A and M Research Foundation were contracted to perform mapping, monitoring, sampling, and submersible observations of several topographic features in the Gulf of Mexico. These features included Stetson, 28 Fathom, East Flower Garden, Claypile, Aransas, South Baker, Southern, Hospital, and North Hospital Banks. Detailed bathymetric charts were prepared for these banks. Biological and geological reconnaisance studies were also conducted on these banks. GRA

N79-28663# Texas A&M Univ., College Station. Dept. of Oceanography.
NORTHWESTERN GULF OF MEXICO TOPOGRAPHIC FEATURES STUDY
Thomas J. Bright and Richard Rezak Dec. 1978 693 p refs
(Contract DI-AA550-CT7-15)
(PB-294769/5; BLM/YM/ES-78/04) Avail: NTIS HC A99/MF A01 CSCL 08J

The work effort is a continuation of FY-76 efforts that were previously reported, and includes mapping, sampling, submersible and monitoring efforts on selected banks in the Gulf of Mexico. Studies include current measurement, hydrography, dye emission, drift bottles, descriptive geology, sedimentology, suspended sediment dispersal, descriptive biology, the East Flower Garden Bank monitoring system, hydrocarbons and trace metals in macronekton and Spondylus, high molecular weight hydrocarbons in sediments, the chemical aspect of the brine lake at the East Flower Garden Bank, and the meiofauna and macroinfauna of selected banks. Reconnaissance studies were conducted at the following banks: Bouma, Bright, Claypile, East Flower Garden, 18 Fathom, Ewing, Parker, Sonnier, and Sackett. Detailed bathymetric maps were also prepared for these banks. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N79-28664 Kansas State Univ., Manhattan.
THE KINETICS OF IGNITION AND PARTICLE BURNOUT OF COAL DUST SUSPENSIONS UNDER RAPID HEATING CONDITIONS Ph.D. Thesis
William Randall Seeker 1978 208 p
Avail: Univ. Microfilms Order No. 7915183

Many features of the ignition and burnout of high volatile bituminous pulverized coal, subjected to a high rate (1,000,000 to 10,000,000 K/sec) of convective heating were delineated. In particular, particles of sized samples of coals were dispersed from a small plate in a shock tube by the incident shock, forming a particulate cloud, which was subsequently heated by the reflected shock. The shock heated dust cloud was optically probed via transmission of a continuous wave laser and emission of

the incandescent cloud for indications of ignition and burnout. Gas samples were taken and analyzed via gas chromatography for low molecular weight hydrocarbons. A technique was developed wherein the surface oxidation rate of the particles in the cloud were determined from an analysis of the rate of increase in laser transmission after ignition using Mie theory calculations. Dissert. Abstr.

N79-28665 California Univ., Berkeley.
SOLAR ENERGY FIXATION AND CONVERSION WITH ALGAL BACTERIAL SYSTEMS Ph.D. Thesis
Moshe Uziel 1978 234 p
Avail: Univ. Microfilms Order No. 7914797

Research on methane fermentation of algae as part of an integrated biological process of solar energy fixation and conversion to natural gas, along with purification of waste water, is described. The research was initiated since there is a need for alternative energy sources and methods for pollution control. The process involves growth of algae and bacteria on waste water, harvesting of algae, methane fermentation of algae, and use of the product of fermentation and combustion for additional algae growth. Defined growth media and conditions for growth of this algae are described, as are anaerobic fermentation chemostats and analytical procedures for measurement and analysis of fermentation gases, fatty acids, and other chemical parameters. Comparative fermentability of the six species of algae were studied. Dissert. Abstr.

N79-28666 California Univ., Los Angeles.
THE EFFECT OF GRAIN BOUNDARIES AND SURFACE DAMAGE ON p-n JUNCTION SILICON SOLAR CELLS Ph.D. Thesis
Taher Daud 1979 193 p
Avail: Univ. Microfilms Order No. 7915651

Two aspects of low cost silicon p-n junction solar cells were investigated. The first aspect concerns grain boundaries in polycrystalline material, whereas the second deals with the surface damage as a result of sawing of single crystal silicon by Multi-Blade Slurry saw. In case of polycrystalline silicon, the effect of recombination at a grain boundary (gb) is measured by way of nonuniform diffusion length of the minority carriers. Based on these measurements, an analytical model was developed for calculation of the short circuit current for columnar grain solar cells. For the effect of the saw damage on single crystal solar cells the effect was studied by fabrication of the solar cells on wafers with varying depth of silicon surface removed. Dissert. Abstr.

N79-28667*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SOLAR TRACKING SYSTEM Patent Application
Paul R. White and Donald R. Scott, inventors (to NASA) Filed 25 Feb. 1979 16 p
(NASA-Case-MFS-23999-1; US-Patent-Appl-SN-060435) Avail: NTIS HC A02/MF A01 CSCL 10A

A solar collector is angularly oriented by motor wherein the output of two side-by-side photodetectors are discriminated as to three ranges, corresponding to a low light or darkness condition by east control circuit to light intensity lying in an intermediate range by pointing control circuit; and to light above an intermediate range, direct sunlight, by differential tracking circuit. The first output drives the motor to a selected maximum easterly angular position to await sunrise; the second enables the motor to be driven westerly at the earth rotational rate when clouds are present which prevent accurate tracking; and the third output, actually the separate outputs of the two photodetectors, differentially controls the direction of rotation of motor through east drive relay and west drive relay to effect tracking of the sun. NASA

N79-28668# California Univ., Livermore. Lawrence Livermore Lab.
PROGRAM REPORT FOR FY 1978: ATMOSPHERIC AND GEOPHYSICAL SCIENCES DIVISION OF THE PHYSICS DEPARTMENT
J. B. Knox, ed. and R. C. Orphan, ed. Dec. 1978 75 p refs Sponsored by DOE
(UCRL-51444-78) Avail: NTIS HC A04/MF A01

The environmental issues addressed by G Division research, the technical objectives of the program, and the highlights of program accomplishments in FY-1978 are presented. A summary of G Division's numerical modeling capabilities is given, as well as an annotated bibliography of the division's publications in the atmospheric sciences during FY-1978. Supplementary material on budget and staffing is included. M.M.M.

N79-28669*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE 11TH ANNUAL BATTERY WORKSHOP
1978 545 p Workshop held at Goddard Space Flight Center, Greenbelt, Md., 15-17 Nov. 1978
(NASA-CP-2088) Avail: NTIS HC A23/MF A01 CSCL 10C

The development, properties, and testing of nickel cadmium, metal hydrogen, and lithium systems are discussed, as well as their applications and related safety factors. For individual titles, see N79-28670 through N79-28720.

N79-28670*# National Aeronautics and Space Administration, Washington, D. C.
FUTURE THRUSTS OF THE NASA SPACE POWER PROGRAM
Lee Holcomb *In* NASA. Goddard Space Flight Center 11th Ann. Battery Workshop 1978 p 5-16 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

General objectives and plan directions are given for current program support in the following areas: (1) solar cells and arrays; (2) batteries and fuel cells; (3) thermoelectric, thermionic, and Brayton cycle conversion systems; (4) circuits and subsystems for the management and distribution of power; and (5) the interactions of the environment with the power system and the spacecraft. Particular emphasis is given to the electrochemical energy conversion storage portion of the program where efforts are directed to improving the energy density and life of nickel cadmium batteries, to validating flight-weight silver hydrogen cells, to promoting the safe use of lithium promary batteries, to completing the silver zinc batteries and the orbital transfer fuel cell technology, to increasing the capacity of space batteries, to and to evaluating new electrochemical concepts for very high energy density. The use of the fuel cell electrolyzer concept for energy storage in both the dedicated and the truly regenerative mode is also being investigated. A.R.H.

N79-28671*# Naval Surface Weapons Center, White Oak, Md.
LIGHTWEIGHT ELECTRODES
Ray Sutula *In* NASA. Goddard Space Flight Center 11th Ann. Battery Workshop 1978 p 17-30 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

The fabrication of a lightweight composite nickel hydroxide electrode based on nickel-coated graphite is described and its effect on the load to failure and electrical resistivity of nickel cadmium and nickel zinc systems was evaluated. The use pure lead in lead acid batteries for submarines is also discussed. A.R.H.

N79-28672*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LIGHTWEIGHT POROUS PLASTIC PLAQUE
Margaret Reid *In* NASA. Goddard Space Flight Center 11th Ann. Battery Workshop 1978 p 31-42 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

The porosity and platability of various materials were investigated to determine a suitable substrate for nickel-plated electrodes. Immersion, ultrasonics, and flow-through plating techniques were tried using nonproprietary formulations, and proprietary phosphide and boride baths. Modifications to the selected material include variations in formulation and treatment, carbon loading to increase conductivity, and the incorporation of a grid. Problems to be solved relate to determining conductivities and porosities as a function of amount of nickel plated on the plastics; loading; charge and discharge curves of electrodes at different current densities; cell performance; and long-term degradation of electrodes. A.R.H.

N79-28673*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CHEMICAL ANALYSIS OF POSITIVE AND NEGATIVE PLATES, A SURVEY
Gerald Halpert *In its* 11th Ann. Battery Workshop 1978 p 43-48 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

Regular arrays of 1 inch discs cut from chemically impregnated positive and negative plates were sent to various contractors and government organizations for chemical analysis in order to determine whether there is consistency in analysis. Techniques used included NASA procedures as specified, variations, wet chemical techniques, and atomic absorption. The weight, thickness of disc, and active material quantity as measured by four respondants are discussed. A.R.H.

N79-28674*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CELL DESIGN AND MANUFACTURING CHANGES DURING THE PAST DECADE
David Baer *In its* 11th Ann. Battery Workshop 1978 p 49-56 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

Eight of the most important changes that occurred in the GE 12 AH cell over the past ten years, which are currently being used are evaluated, and a systematic approach to compare their relative merits is presented. Typical positive thickness, typical negative thickness, positive loading, negative loading, final KOH quantity, and precharge as adjustment are shown for the control cell, and the following variables: Teflon treatment; silver treatment; light loading; no PQ treatment; polypropylene separator; the A.K. 1968 plate design no PQ, old elec process, no decarb process and the A.K. 1968 plate design, no PQ, present aerospace processes. The acceptance test cell voltage and cell pressure performance and capacity test results are included. A.R.H.

N79-28675*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPARISON OF CELLS WITH PELLON 2503 AND 2505 SEPARATOR
Gerald Halpert *In its* 11th Ann. Battery Workshop 1978 p 57-63 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

Unlike the 2505 nonwoven nylon separator material which has fibers in a random direction, the 2503 material has fibers oriented all in one direction. Properties of the two materials discussed include density, porosity, absorptivity, electrolyte retention, capacity, and charge voltage pressure. With only 1,000 test cycles completed, it is not possible to determine whether 2503 is a suitable substitute. A.R.H.

N79-28676*# Boeing Aerospace Co., Seattle, Wash.
CHARACTERIZATION OF DEGRADED NICKEL CADMIUM CELLS
Sidney Gross *In* NASA. Goddard Space Flight Center 11th Ann. Battery Workshop 1978 p 65-74 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

Various cells were cycled until degradation and then tested to determine the electrochemical characterization of the cells with regard to charge control. A constant voltage charged to a temperature-biased voltage, using up to an 8-voltage limit was used for the evaluation. Graphs show severe discharge voltage degradation with cycling and periodic capacity discharge; voltage extremes for cells with and without periodic capacity discharges; voltage extremes for cells with high rate discharge; voltage-temperature levels used for charge control; end of charge current and discharge voltage for 5 percent DOD cycling; cell capacity following 5 percent DOD cycling; and the end of discharge voltage and typical charge current profiles for the 20 percent DOD cycling. A.R.H.

N79-28677*# Coppin State Coll., Washington, D. C.
DYNAMICS OF CELL DEGRADATION
Patrick P. McDermott *In* NASA. Goddard Space Flight Center 11th Ann. Battery Workshop 1978 p 75-85 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

The use of chemical and physical data as a supplement to linear regression models in the prediction of cell failure is discussed. Principal factors to be considered are the positive thickness and weight, and the negative thickness. A model for cell degradation and failure in accelerated life test cells is presented and predictions based on a teardown analysis are included. A.R.H.

N79-28678*# ILC Technology, Inc., Sunnyvale, Calif.
CERAMIC-METAL SEALS FOR ADVANCED BATTERY SYSTEMS
Leonard Reed *In* NASA. Goddard Space Flight Center 11th Ann. Battery Workshop 1978 p 87-100 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

The search for materials which are electrochemically compatible with the lithium sulfur and sodium sulfur systems is discussed. The use liquid or braze alloys, titanium hydrite coatings, and tungsten yttria for bonding beryllium with ceramic is examined. A.R.H.

N79-28679*# Naval Weapons Support Center, Crane, Ind.
ACCELERATED TEST PROGRAM AT CRANE
Harry Brown *In* NASA. Goddard Space Flight Center 11th Ann. Battery Workshop 1978 p 103-109 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

Statistical analysis of work performed, the present status, and the future plans of the program are summarized. S.E.S.

N79-28680*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DATA ANALYSIS FOR THE ACCELERATED TEST
Sam Bogner *In* NASA. Goddard Space Flight Center 11th Ann. Battery Workshop 1978 p 110-117 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

Test variables discussed graphically include the effects of: (1) ambient temperature; (2) depth of the discharge; (3) discharge rate; (4) percent of recgargel (5) KOH concentration; (6) KOH volume; (7) charge rate and (8) negative per charge. S.E.S.

N79-28681*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ACCELERATED TEST MODELING
Diane Schwartz *In* NASA. Goddard Space Flight Center 11th Ann. Battery Workshop 1978 p 119-133 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

Cycle life regression model, cycle life prediction model, and acceleration factors are discussed. A method was presented to: (1) select a mathematical model; (2) determine model coefficients using accelerated test data; (3) test model fit of the accelerated test data; and (4) predict normal packs. S.E.S.

N79-28682*# Coppin State Coll., Washington, D. C.
NONLINEAR PREDICTION MODELING FOR ACCELERATED TESTING
Patrick P. McDermott *In* NASA. Goddard Space Flight Center 11th Ann. Battery Workshop 1978 p 135-147 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

Empirical equation derived from cycles-to-failure, temperature cells, and prediction of normal packs are presented. S.E.S.

N79-28683*# Bell Telephone Labs., Inc., Murray Hill, N. J.
SYNCHRONOUS ORBIT MODELS
D. W. Maurer *In* NASA. Goddard Space Flight Center 11th Ann. Battery Workshop 1978 p 149-154 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

The NASA guidelines for synchronous orbits are presented. Mathematical models are developed which encompass all test variables and systems engineering. S.E.S.

N79-28684*# Hughes Aircraft Co., Los Angeles, Calif.
HUGHES/GE IMPROVED NiCd CELL DESIGN
Stan Krause *In* NASA. Goddard Space Flight Center 11th Ann. Battery Workshop 1978 p 155-162 (For primary document see N79-28669 19-44)

Avail: NTIS HC A23/MF A01 CSCL 10C

Synchronous orbit and elliptical orbit life tests are used to make improvements in cell design for spacecraft application. The test increased the electrolyte volume and the surface area in cells to reduce the current density on charge and discharge. S.E.S.

N79-28685*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STANDARD CELL DATA
Gerald Halpert *In its* 11th Ann. Battery Workshop 1978 p 163-170 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

Performance tests of the mechanical designs of nickel cadmium cells are presented. The framework of the manufacturing and processing of these cells is described. S.E.S.

N79-28686*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
SINGLE CELL RECONGIDIONING TEST
V. C. Mueller *In* NASA. Goddard Space Flight Center 11th Ann. Battery Workshop 1978 p 171-181 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

Reconditioning the voltage and current profiles, capacity discharge and current, and charge and discharge cycles are presented. S.E.S.

N79-28687*# Aerospace Corp., Los Angeles, Calif.
HIGH RATE OF REVERSAL IN NiCd CELLS
Harry Killian *In* NASA. Goddard Space Flight Center 11th Ann. Battery Workshop 1978 p 183-198 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

Pressure response to reverse current, pressure decay after reversal, and discharge performance of nickel cadmium cells are presented. S.E.S.

N79-28688*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PARALLEL BATTERY TEST RESULTS
Charles Palandati *In its* 11th Ann. Battery Workshop 1978 p 201-211 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

The effects of disabling and enabling the charger on one of two batteries that are operating in a parallel mode are discussed. S.E.S.

N79-28689*# Naval Research Lab., Washington, D. C.
VOLTAGE/TEMPERATURE CHARGE CHARACTERISTICS
Frederick E. Betz *In* NASA. Goddard Space Flight Center 11th Ann. Battery Workshop 1978 p 213-228 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

A series of nickel cadmium batteries were tested to determine the effects of boltages and various temperatures on the charge discharge ratios and the recharge percentage. It was concluded that the selection of a proper temperature should consider the satellite orbit characteristics, the cell operating characteristics, the battery operating temperature range, and the final taper charge current. M.M.M.

N79-28690*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IUE FLIGHT EXPERIENCE
Sid Tiller *In its* 11th Ann. Battery Workshop 1978 p 229-237 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

Nickel cadmium batteries were designed to provide an alternate booster energy source to the IUE satellite during eclipse periods. Data shows the spacecraft can operate over the three year design life and a five year design goal. M.M.M.

N79-28691*# Martin Marietta Corp., Denver, Colo.
VIKING FLIGHT DATA AFTER 24 MONTHS ON MARS SURFACE
J. Lear *In* NASA. Goddard Space Flight Center 11th Ann. Battery Workshop 1978 p 239-247 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

An update of the Viking landers after two years of operation is presented along with an evaluation of the battery system aboard the spacecrafts which supplied them with an alternate booster energy source. M.M.M.

N79-28692*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SYNOPSIS OF VIKING FLIGHT DATA
A. O. Britting *In* NASA. Goddard Space Flight Center 11th Ann. Battery Workshop 1978 p 249-251 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

The temporary failure of the data collection hardware along with the fifty percent degradation on the batteries in lander 1 were discussed. M.M.M.

N79-28693*# RCA American Communications, Inc., Piscataway, N. J.
RCA SATCOM IN ORBIT: RECONDITIONING AND FLIGHT EXPERIENCE
Joseph Napoli *In* NASA. Goddard Space Flight Center 11th Ann. Battery Workshop 1978 p 253-265 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

The performance of the nickel cadmium batteries on the SATCOM in orbit, and the effects of aging and changes in temperature due to eclipses are described. A description of the battery reconditioning is presented. M.M.M.

N79-28694*# Defence Research Establishment, Ottawa. (Ontario).
CANADIAN TECHNOLOGY SATELLITE, AN UPDATE
Joseph Lackner *In* NASA. Goddard Space Flight Center 11th Ann. Battery Workshop 1978 p 267-269 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

An update on the performance of the nickel cadmium batteries on the Communications Technology Satellite is presented. The wattage and capacity during the winter and summer solstices are pointed out. M.M.M.

N79-28695*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HCMM/SAGE TEST RESULTS
Floyd Ford *In its* 11th Ann. Battery Workshop 1978 p 271-285 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

The salient features of the nickel cadmium batteries used in the Heat Capacity Mapping Mission spacecraft and the SAGE satellite are presented. Life tests, battery profiles, and recommendations for structural improvement are reported. M.M.M.

N79-28696*# Canadian Astronautics Ltd., Ottawa (Ontario).
MICROPROCESSOR CONTROLLED ADVANCED BATTERY MANAGEMENT SYSTEMS
W. T. Payne *In* NASA. Goddard Space Flight Center 11th Ann. Battery Workshop 1978 p 287-299 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

The advanced battery management system described uses the capabilities of an on-board microprocessor to: (1) monitor the state of the battery on a cell by cell basis; (2) compute the state of charge of each cell; (3) protect each cell from reversal; (4) prevent overcharge on each individual cell; and (5) control dual rate reconditioning to zero volts per cell. M.M.M.

N79-28697*# Eagle-Picher Co., Joplin, Mo.
AIR FORCE ELECTROCHEMICAL IMPREGNATION PROCESS RESULTS
Lee E. Miller *In* NASA. Goddard Space Flight Center 11th Ann. Battery Workshop 1978 p 303-308 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

The status of the Air Force Electrochemical program was reviewed. The performance characteristics of the system was attributed to the use of an electrochemical impregnation process. The electrode improvements, the prototype equipment designs,

and the actual construction of a production facility are discussed. M.M.M.

N79-28698*# Comsat Labs., Clarksburg, Md.
NTS-2 BATTERY AFTER 1 YEAR AND 3 ECLIPSE SEASONS
Joseph Stockel *In* NASA. Goddard Space Flight Center 11th Ann. Battery Workshop 1978 p 309-315 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

The performance of the nickel hydrogen batteries on board the NTS-2 satellite was determined after being in orbit for several months. The effects of the eclipses were presented as well as the power loading operations. M.M.M.

N79-28699*# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
USAF NICKEL HYDROGEN CELL
Don R. Warnock *In* NASA. Goddard Space Flight Center 11th Ann. Battery Workshop 1978 p 317-329 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

Air Force activities in nickel hydrogen battery research were summarized. The latest developments for the past year were discussed and applications of the nickel hydrogen batteries were reviewed. R.E.S.

N79-28700*# Hughes Aircraft Co., Los Angeles, Calif.
ACCEPTANCE TEST DATA ON HUGHES-USAF LIGHTWEIGHT NICKEL HYDROGEN CELLS
Howard H. Rogers *In* NASA. Goddard Space Flight Center 11th Ann. Battery Workshop 1978 p 331-340 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

Cell capacity, stabilization cycling, and failure analysis data on 50 A hour lightweight nickel hydrogen cells is presented and discussed. R.E.S.

N79-28701*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
LIFE TEST OF NiH2 FLIGHT BATTERY
Martin G. Gandel *In* NASA. Goddard Space Flight Center 11th Ann. Battery Workshop 1978 p 341-346 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

Life cycle tests being run on the 50 A lightweight nickel hydrogen flight battery are discussed and the preliminary results are presented. R.E.S.

N79-28702*# EIC, Inc., Newton, Mass.
CONFIGURATION ANALYSIS OF NICKEL HYDROGEN CELL
G. Holleck *In* NASA. Goddard Space Flight Center 11th Ann. Battery Workshop 1978 p 347-359 refs (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

The significance of various stack configurations and components on the cycle life for nickel hydrogen cells for synchronous orbit used was evaluated. Failure modes of electrolyte management and 02 management were solved by modifications in the reservoir, the wick, and/or the stack configuration. R.E.S.

N79-28703*# Rockwell International Corp., Downey, Calif.
COMMON PRESSURE VESSEL BATTERY PERFORMANCE
B. Otzinger *In* NASA. Goddard Space Flight Center 11th Ann. Battery Workshop 1978 p 361-370 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

Performance tests run on two common pressure vessel type nickel hydrogen batteries are described and the results presented. The study included: (1) charge retention tests, (2) synchronous eclipse season cycling tests, and (3) temperature differential tests. R.E.S.

N79-28704*# EIC, Inc., Newton, Mass.
SILVER HYDROGEN BATTERIES
G. Holleck *In* NASA. Goddard Space Flight Center 11th Ann. Battery Workshop 1978 p 371-381 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

The feasibility of silver hydrogen batteries was investigated. Cell configurations and cell cycling were discussed. Energy density was found to be 65 to 100 watt hours per kilogram. Electrolyte management was considered critical to the cell's performance. Factors of electrolyte management which were particularly important were: (1) the nature of the separator system, and (2) the amount of electrolyte. R.E.S.

N79-28705*# Ford Aerospace and Communications Corp., Palo Alto, Calif.
SILVER HYDROGEN VOLTAGE/PRESSURE PERFORMANCE
Charles W. Koehler *In* NASA. Goddard Space Flight Center 11th Ann. Battery Workshop 1978 p 383-391 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

High pressure tests were run on silver hydrogen cells in order to determine: (1) the self discharge characteristics at 1000 and 2000 psig; (2) the state of charge parameters; and (3) the trickle charge rates. These results were then compared with pressure test results from a nickel hydrogen cell. R.E.S.

N79-28706*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NASA LITHIUM CELL APPLICATIONS
Gordon L. Juvinall *In* NASA. Goddard Space Flight Center 11th Ann. Battery Workshop 1978 p 395-410 refs (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

The advantages of lithium systems are described and a general summary of their application in present and future NASA programs is presented. Benefits of the lithium systems include an increased payload weight and an increased cost effectiveness to the customer. This also allows for more flexibility in the design of future space transportation systems. R.E.S.

N79-28707*# Naval Surface Weapons Center, White Oak, Md.
US NAVY LITHIUM CELL APPLICATIONS
F. M. Bowers *In* NASA. Goddard Space Flight Center 11th Ann. Battery Workshop 1978 411-420 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

Applications of lithium systems that are already in the fleet are discussed. The approach that the Navy is taking in the control of the introduction of lithium batteries into the fleet is also discussed. R.E.S.

N79-28708*# National Aeronautics and Space Administration, Washington, D. C.
SHUTTLE PAYLOAD REQUIREMENTS AND IMPLEMENTATION PROCEDURE
John A. Scheller *In* NASA. Goddard Space Flight Center 11th Ann. Battery Workshop 1978 p 421-429 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

Payload safety guidelines and implementation procedures which were revised to include updated sections on energy storage batteries are presented. R.E.S.

N79-28709*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NASA'S LITHIUM CELL TECHNOLOGY PROGRAM
Gordon L. Juvinall *In* NASA. Goddard Space Flight Center 11th Ann. Battery Workshop 1978 p 431-440 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

Briefly outlined are the activities of the various research centers involved in the NASA program. Graphs are presented for: (1) the initial results on SOCl2 decomposition rate; (2) effect of rate on output of Li-SOCl2 cells; (3) comparison of high and low rate Li-SOCl2 cells; and (4) effect of temperature on output of Li-SOCl2 cells. Abusive test results and a description of secondary lithium cells are also presented. G.Y.

N79-28710*# Army Electronics Technology and Devices Lab., Fort Monmouth, N. J.
US ARMY LITHIUM CELL APPLICATIONS
Alfred J. Legath *In* NASA. Goddard Space FLight Center,

11th Ann. Battery Workshop 1978 p 441-448 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

The how, why and where the Army is applying lithium batteries are addressed. The Army is committing its efforts to the utilization of lithium batteries in new equipment that will be going into the field possibly from FY-80 and therafter. The Army's philosophy is to guide their users and the equipment designers, to use battery packs are opposed to singel cells. After a detailed description of the battery types that are being considered, a discussion is presented in which questions and comments are exchanged among the Workshop participants. G.Y.

N79-28711*# Little (Arthur D.), Inc., Cambridge, Mass.
HAZARDS OF LITHIUM THIONYL CHLORIDE BATTERIES
John M. Parry *In* NASA. Goddard Space Flight Center 11th Ann. Battery Workshop 1978 p 449-458 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

Two different topics which only relate in that they are pertinent to lithium thionyl chloride battery safety are discussed. The first topic is a hazards analysis of a system (risk assessment), a formal approach that is used in nuclear engineering, predicting oil spills, etc. It is a formalized approach for obtaining assessment of the degree of risk associated with the use of any particular system. The second topic is a small piece of chemistry related to the explosions that can occur with lithium thionyl chloride systems. After the two topics are presented, a discussion is generated among the Workshop participants. G.Y.

N79-28712*# Boeing Aerospace Co., Seattle, Wash.
SEAL PROBLEMS OF LITHIUM CELLS
Sidney Gross *In* NASA. Goddard Space Flight Center 11th Ann. Battery Workshop 1978 p 459-464 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

The problem of leakage through a seal in lithium cells is addressed. The use of ceramic and glass-to-metal seals is briefly discussed. Comments are presented from the Workshop participants. G.Y.

N79-28713*# Naval Surface Weapons Center, White Oak, Md.
CHARACTERISTICS OF Li-SOCl2 CELLS
Donald L. Warburton *In* NASA Goddard Space Flight Center 11th Ann. Battery Workshop 1978 p 465-474 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

A general discussion of the characteristics of Li-SOCl2 cells is presented. Three different shaped cells were selected for syudy; prismatic, cylindrical, and disc. The characteristics of the cells were obtained through nondestructive and destructive testing which are discussed. Graphs are presented which represent the various parameters investigated. Workshop participant comments and questions are also included. G.Y.

N79-28714*# General Electric Co., Philadelphia, Pa.
TRADEOFF ANALYSIS WITH LITHIUM CELLS
Charles Bennett *In* NASA. Goddard Space Flight Center 11th Ann. Battery Workshop 1978 p 475-487 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

Characteristic data, primarily on high rate lithium sulfur dioxide design (basically in the D and DD cell configuration), both before and after much exposure to environmental conditions are discussed. The environmental as opposed to signle cells. Discussion was generated among the Workshop participants and comments and questions are reported. Graphical representeations of the test data are presented. G. Y.

N79-28715*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LIFE TESTING OF MALLORY CELLS
Duane Dugan *In* NASA. Goddard Space Flight Center 11th Ann. Battery Workshop 1978 p 489-497 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

Tests were performed to assess the effects of storage time, storage temperature, vibration, discharge rate and temperature, and capacity of high-rate, D size, lithium sulfur dioxide cells. Data from these tests are discussed. G.Y.

N79-28716*# GTE Sylvania, Inc., Needham Heights, Mass.
LARGE CELLS AND THEIR PERFORMANCE
Franz Goebel *In* NASA. Goddard Space Flight Center 11th Ann. Battery Workshop 1978 p 499-503 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

Some of the large primary cells presently made, ranging from 2,000 to 10,000 ampere-hours are discussed. Performance data obtained on a 2,000 ampere-hour cell are graphically presented. G.Y.

N79-28717*# GTE Sylvania, Inc., Needham Heights, Mass.
SAFETY AND ABUSE TESTING
Gilbert Younger *In* NASA. Goddard Space Flight Center 11th Ann. Battery Workshop 1978 p 505-510 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

A series of abuse tests on large lithium thionyl chloride cells was initiated. Performance data obtained in testing rectangular 2,000 and 10,000 ampere-hour cells are discussed and graphically presented. G.Y.

N79-28718*# Honeywell, Inc., Horsham, Pa.
APPLICATIONS AND SAFETY DATA
N. J. Berlangieri *In* NASA. Goddard Space Flight Center 11th Ann. Battery Workshop 1978 p 511-530 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

A general overview of activities involving lithium batteries, which shows the various applications and data that were performed for numerous industry and government sponsors is presented. Brief discussions on electrochemical criteria selection, and typical storage and performance data obtained from three systems being developed are presented. Current safety work being done on high-rate, D, SO2 cells is also discussed. Three chemistries were developed and are discussed: lithium vanadium pentoxide, lithium sulfur dioxide, and lithium thionyl chloride. Storage, performance and safety data are graphically presented. G.Y.

N79-28719*# Plainview Electronics Corp., N. Y.
TADIRAN-PLAINVIEW ELECTRONICS PRESENTATION
Bernard Erde *In* NASA. Goddard Space Flight Center 11th Ann. Battery Workshop 1978 p 531-538 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

Various environmental, mechanical, vibration, shock, etc., test were run on the manufacturer's lithium cells. The data obtained from these tests are graphically presented and briefly discussed. G.Y.

N79-28720*# Power Conversion, Inc., Mount Vernon, N. Y.
SAFETY CHARACTERISTICS OF THE LITHIUM SO2 SYSTEM
Tom Watson *In* NASA. Goddard Space Flight Center 11th Ann. Battery Workshop 1978 p 539-548 (For primary document see N79-28669 19-44)
Avail: NTIS HC A23/MF A01 CSCL 10C

Extensive tests were conducted to quantitatively define the safety characteristics of high-rate SO2 multicell batteries under various discharge and temperature profiles, which closely simulated actual field-use conditions. The resulting behavior patters of the multicell batteries and the corrective action which can be implemented to minimize or prevent hazardous battery performance are briefly summarized. G.Y.

N79-28721*# Engineering Olympic Corp., Richland, Wash.
SOLAR HEATING, COOLING, AND HOT WATER SYSTEMS INSTALLED AT RICHLAND, WASHINGTON **Final Report**
Jun. 1979 258 p Sponsored by NASA
(Contract EX-76-C-01-2404)
(NASA-CR-161237; OEC-ER-014) Avail: NTIS HC A12/MF A01 CSCL 10A

The project described is part of the U. S. Department of Energy's solar demonstration program, and became operational in April 1978. The solar system uses 6,000 square feet of flat-plate

liquid collectors in a closed loop to deliver solar energy through a liquid-liquid heat exchanger to the building heat-pump duct work or 9,000-gallon thermal energy storage tank. A 25-ton Arkla solar-driven absorption chiller provides the cooling, in conjunction with a 2,000 gallon chilled water storage tank and reflective ponds on three sides of the building surplus heat. A near-by building is essentially identical except for having conventional heat-pump heating and cooling, and can serve as an experimental control. An on-going public relations program was provided from the beginning of the program, and resulted in numerous visitors and tour groups. M.M.M.

N79-28722*# Westinghouse Research and Development Center, Pittsburgh, Pa.

SILICON WEB PROCESS DEVELOPMENT Annual Report, Apr. 1978 - Apr. 1979

C. S. Duncan, R. H. Hopkins, R. G. Seidensticker, J. P. McHugh, F. E. Hill, M. E. Heimlich, and J. M. Driggers Apr. 1979 233 p refs Sponsored by NASA Prepared for DOE and JPL

(Contract JPL-954654)

(NASA-CR-158852; DOE/JPL-954654-79/7) Avail: NTIS HC A11/MF A01 CSCL 10A

Silicon dendritic web, a single crystal ribbon shaped during growth by crystallographic forces and surface tension (rather than dies), is a highly promising base material for efficient low cost solar cells. The form of the product smooth, flexible strips 100 to 200 microns thick, conserves expensive silicon and facilitates automation of crystal growth and the subsequent manufacturing of solar cells. These characteristics, coupled with the highest demonstrated ribbon solar cell efficiency-15.5%-make silicon web a leading candidate to achieve, or better, the 1986 Low Cost Solar Array (LSA) Project cost objective of 50 cents per peak watt of photovoltaic output power. The main objective of the Web Program, technology development to significantly increase web output rate, and to show the feasibility for simultaneous melt replenishment and growth, have largely been accomplished. Recently, web output rates of 23.6 sq cm/min, nearly three times the 8 sq cm/min maximum rate of a year ago, were achieved. Webs 4 cm wide or greater were grown on a number of occassions. F.O.S.

N79-28723*# Ross (Bernd) Associates, San Diego, Calif.

DEVELOPMENT OF ECONOMICAL IMPROVED THICK FILM SOLAR CELL CONTACT Final Report, Sep. 1978 - Apr. 1979

Bernd Ross Apr. 1979 74 p refs Sponsored by NASA Prepared for DOE and JPL

(NASA-CR-158848; DOE/JPL-955164-79/2) Avail: NTIS HC A04/MF A01 CSCL 10A

Materials were surveyed to provide candidates for an all metal electrode paste system. These consisted of a major constituent metal powder, a low melting metal powder suitable for a liquid phase sintering medium, and a powder material suitable as an etchant for silicon dioxide at sintering temperatures. By means of thermal gravimetric analysis a suitable binder was identified for low temperature fired inks. G.Y.

N79-28724*# Clemson Univ., S.C. Dept. of Electrical and Computer Engineering.

INVESTIGATION OF RELIABILITY ATTRIBUTES AND ACCELERATED STRESS FACTORS ON TERRESTRIAL SOLAR CELLS

J. L. Prince and J. W. Lathrop May 1979 276 p

(Contract JPL-954929)

(NASA-CR-158854; DOE/JPL-954929-79/4; AR-1; DRD-SE-7) Avail: NTIS HC A13/MF A01 CSCL 10A

The results of accelerated stress testing of four different types of silicon terrestrial solar cells are discussed. The accelerated stress tests used included bias-temperature tests, bias-temperature-humidity tests, thermal cycle and thermal shock tests, and power cycle tests. Characterization of the cells was performed before stress testing and at periodic down-times, using electrical measurement, visual inspection, and metal adherence pull tests. Electrical parameters measured included short-circuit current, open circuit voltage, and output power, voltage, and current at the maximum power point. Incorporated in the report are the distributions of the prestress electrical data for all cell types. Data were also obtained on cell series and shunt resistance. Author

N79-28725*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SAFETY CONSIDERATIONS IN THE DESIGN AND OPERATION OF LARGE WIND TURBINES Final Report

Dwight H. Reilly Jun. 1979 38 p refs Sponsored in part by DOE

(Contract DE-AI01-79ET20305)

(NASA-TM-79193; E-067; DOE/NASA/20305-79/3) Avail: NTIS HC A03/MF A01 CSCL 10B

The engineering and safety techniques used to assure the reliable and safe operation of large wind turbine generators utilizing the Mod 2 Wind Turbine System Program as an example is described. The techniques involve a careful definition of the wind turbine's natural and operating environments, use of proven structural design criteria and analysis techniques, an evaluation of potential failure modes and hazards, and use of a fail safe and redundant component engineering philosophy. The role of an effective quality assurance program, tailored to specific hardware criticality, and the checkout and validation program developed to assure system integrity are described. Author

N79-28726*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

STIRLING ENGINES FOR AUTOMOBILES

Donald G. Beremand 1979 15 p refs Proposed for presentation at Intern. Conf. on Energy Use Management, Los Angeles, Calif., 22-26 Oct. 1979 Sponsored in part by DOE

(Contract EC-77-A-31-1040)

(NASA-TM-79222; E-116) Avail: NTIS HC A02/MF A01 CSCL 10B

The results of recent and ongoing automobile Stirling engine development efforts are reviewed and technology status and requirements are identified. Key technology needs include those for low cost, high temperature (1300 - 1500 F) metal alloys for heater heads, and reliable long-life, low-leakage shaft seals. Various fuel economy projections for Stirling powered automobiles are reviewed and assessed. Author

N79-28727*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

DESIGN, FABRICATION, AND INITIAL TEST OF A FIXTURE FOR REDUCING THE NATURAL FREQUENCY OF THE MOD-0 WIND TURBINE TOWER

J. R. Winemiller, T. L. Sullivan, R. L. Sizemore, and S. T. Yee Jul. 1979 21 p Prepared for DOE

(Contract EX-76-I-01-1028)

(NASA-TM-79200; C-081; DOE/NASA/1028-79/24) Avail: NTIS HC A02/MF A01 CSCL 10B

It was desired to observe the behavior of a two bladed wind turbine where the tower first bending natural frequency is less than twice the rotor speed. The system then passes through resonance when accelerating to operating speed. The frequency of the original Mód-0 tower was reduced by placing it on a spring fixture. The fixture is adjustable to provide a range of tower bending frequencies. Fixture design details are given and behavior during initial operation is described. Author

N79-28728*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECT OF POSITIVE PULSE CHARGE WAVEFORMS ON CYCLE LIFE OF NICKEL-ZINC CELLS Final Report

John J. Smithrick Jul. 1979 14 p refs Sponsored in part by DOE

(Contract EC-77-A-31-1044)

(NASA-TM-79215; E-100; DOE/NASA/1044-79/3) Avail: NTIS HC A02/MF A01 CSCL 10C

Five amp-hour nickel-zinc cells were life cycled to evaluate four different charge methods. Three of the four waveforms investigated were 120 Hz full wave rectified sinusoidal (FWRS), 120 Hz silicon controlled rectified (SCR), and 1 kHz square wave (SW). The fourth, a constant current method, was used as a baseline of comparison. Three sealed Ni-Zn cells connected in series were cycled. Each series string was charged at an average c/20 rate, and discharged at a c/2.5 rate to a 75% rated depth. Author

N79-28729*# Garden State Racing Association, Cherry Hill, N. J.
SOLAR HEATING AND HOT WATER SYSTEM INSTALLED AT CHERRY HILL, NEW JERSEY
16 May 1979 299 p Sponsored by NASA
(Contract EG-77-A-01-4086)
(NASA-CR-161235) Avail: NTIS HC A11/MF A01 CSCL 10A

The solar heating and hot water system installed in existing buildings at the Cherry Hill Inn in Cherry Hill, New Jersey is described in detail. The system is expected to furnish 31.5% of the overall heating load and 29.8% of the hot water load. The collectors are liquid evacuated tube type. The storage system is an above ground insulated steel water tank with a capacity of 7,500 gallons. R.E.S.

N79-28730*# United Technologies Research Center, East Hartford, Conn.
SOLAR SUSTAINED PLASMA/ABSORBER CONCEPTUAL DESIGN Final Report, 1 Aug. 1978 - 28 Feb. 1979
Richard J. Rodgers, Nicholas L. Krascella, and John S. Kendall Feb. 1979 61 p refs
(Contract NAS2-10010)
(NASA-CR-152304; R79-914392) Avail: NTIS HC A04/MF A01 CSCL 10A

A space power system concept was evaluated which uses concentrated solar energy to heat a working fluid to temperatures as high as 4000 K. The high temperature working fluid could be used for efficient electric power production in advanced thermal or magnetohydrodynamic conversion cycles. Energy absorber configurations utilizing particles or cesium vapor absorber material were investigaed. Results of detailed radiant heat transfer calculations indicated approximately 86 percent of the incident solar energy could be absorbed within a 12-cm-dia flowing stream of gas borne carbon particles. Calculated total energy absorption in the cesium vapor seeded absorber configuration ranged from 34 percent to 64 percent of the incident solar energy. Solar flux concentration ratios of between approximately 3000 and 10,000 will be required to sustain absorber temperatures in the range from 3000 K to 4000 K. F.O.S.

N79-28731*# National Aeronautics and Space Administration, Washington, D. C.
THE Si RIBBON CRYSTAL FOR THE SOLAR BATTERY USING THE HORIZONTAL PULL METHOD
Hiroshi Norifuji, Masayoshi Matsuo, and Takeshi Maki Jul. 1979 22 p Transl. into ENGLISH of conf. paper from Japan Silicon Co., Ltd. Presented at Natl. Conv. of Elec. Studies, 1979 p S3-21 - S3-24 Transl. by Sci. Transl. Service, Santa Barbara, Calif.
(Contract NASw-3196)
(NASA-TM-75503) Avail: NTIS HC A02/MF A01 CSCL 10C

A method utilizing a device to spray noble gases to cool the site of silicon crystal growth is described. The salient points are: (1) soft and uniform cooling was possible, (2) the length of the boundary surface of growth along the growth direction was made long over a wide width compared to the thickness, and (3) this made it possible to effectively remove the heat produced from solification. By using forced gas spraying on the solution surface in contact with the points of crystal growth, growth at the points of growth is enhanced and the rate of growth is speeded up. M.M.M.

N79-28732# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
COMBINED CYCLES FOR POWER GENERATION, VOLUME 1
1978 306 p refs Proc. of Lectures held at Rhode-Saint-Genese, Belgium 2 Vol.
(VKI-Lec-Ser-1978-6-Vol-1) Avail: NTIS HC A14/MF A01

Papers included in this lecture series refer to closed cycle gas-turbine steam engines, possibilities of combined cycles, combined gas-steam steam turbine power plants with supplementary firing and the GT/ST cycle in coal gasification. For individual titles, see N79-28733 through N79-28737.

N79-28733# Technische Hochschule, Graz (Austria).
THE CLOSED CYCLE GAS TURBINE - STEAM TURBINE
Joachim Buxmann and Helmut Bormann *In* Von Karman Inst. for Fluid Dyn. Combined Cycles for Power Generation, Vol. 1 1978 59 p refs (For primary document see N79-28732 19-44)
Avail: NTIS HC A14/MF A01

After reviewing thermodynamic fundamentals, the heat transfer between both cycles, the influence on efficiency, and power output are discussed. Reference is made to a closed gas turbine plant where helium is used instead of air for a gas cooled high temperature nuclear reactor and also as the process fluid. The 300 MW 'Ventrop' project, with combined helium gasturbine - steam turbine cycles is discussed. Different variants of circuit schemes and parameter variations are discussed in detail with sets of charts and drawings to illustrate the alternatives. Examples cited are efficiency in function of pressure ratio, TS diagrams, efficiency ratios in function of pressure ratios, and heat input ratio in function of pressure ratio. Author (ESA)

N79-28734# Ateliers de Constructions Electriques de Charleroi (Belgium).
COMBINED CYCLES AND THEIR POSSIBILITIES
A. R. J. Timmermans *In* Von Karman Inst. for Fluid Dyn. Combined Cycles for Power Generation, Vol. 1 1978 58 p (For primary document see N79-28732 19-44)
Avail: NTIS HC A14/MF A01

A combined cycles application for gas-steam turbines is discussed. Firing variations in the steam cycle and factors such as fuel nature, fuel gasification, and degree of equipment complexity are considered. Practical subjects such as available records and plant maintenance problems are commented on. Two Belgium power plants are mentioned as examples of combined cycles applications. For the old Drogenbos plant, an output of 135 MW with a net efficiency of 40 per cent is claimed. In reference to the Socolie 100 MW combined cycle plant, the installation is briefly described and the performance is reported to be 43 percent thermal efficiency for nominal conditions. Author (ESA)

N79-28735# Stadtwerke Saarbruecken (West Germany).
OPERATION OF A COMBINED DISTRICT HEATING AND POWER PRODUCTION SCHEME WITH A COMBINED CYCLE GAS TURBINE
Johannes Flad *In* Von Karman Inst. for Fluid Dyn. Combined Cycles for Power Generation, Vol. 1 1978 41 p (For primary document see N79-28732 19-44)
Avail: NTIS HC A14/MF A01

Steam and gas combined cycles used for district heating in the city of Saarbrucken is described. Performance data with project and operation particulars are discussed. The total efficiency is dependent on the operating mode, being 44 percent in the zero extraction unfired mode, 800.4 percent with 46T/hr district heating extraction for a total steam production of 47 t/hr with no g. With a steam production of 85 t/hr with firing, the efficiency is 54.3 percent with 25 t/hr extraction and 73.9 percent with 6o t/hr extraction. Author (ESA)

N79-28736# Kraftwerk Union A.G. Reaktortechnik, Erlangen (West Germany).
COMBINED GAS/STEAM TURBINE POWER PLANTS WITH SUPPLEMENTARY FIRING
J. Charlier and H. Brueckner *In* Von Karman Inst. for Fluid Dyn. Combined Cycles for Power Generation, Vol. 1 1978 59 p refs (For primary document see N79-28732 19-44)
Avail: NTIS HC A14/MF A01

Combined cycles systems are analyzed, especially those in the high power range. A coal and natural gas fired combined cycles power plant with a 750 MW output is described. Most of the power is produced by the steam turbine arrangement in which additional firing is involved. An efficiency on the order of 40 percent to 42 percent is obtained. Further applications of combined cycles and new developments in Germany are discussed. Author (ESA)

N79-28737# Sulzer Bros. Ltd., Winterthur (Switzerland).
THE GAS TURBINE/STEAM TURBINE CYCLE WITH COAL GASIFICATION
A. Steiner *In* Von Karman Inst. for Fluid Dyn. Combined Cycles

for Power Generation, Vol. 1 1978 43 p refs (For primary document see N79-28732 19-44)
Avail: NTIS HC A14/MF A01

Available processes for solid fuel gasification and subsequent gas desulfuration are described as they are especially suitable GT/ST cycles. Economic arguments and environmental protection regulations are discussed. Coal gasification is analyzed both as fixed bed generators and fluid bed generators. Purification alternatives such as physical washing, chemical washing, physical-chemical washing and absorption are described. A 170 MW coaal gasification combined power plant located at Luner, Germany, is described as an example. A Westinghouse combined cycle plant with 'U-gas' flindized-bed gasification is also discussed. Author (ESA)

N79-28738# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
COMBINED CYCLES FOR POWER GENERATION
1978 318 p refs Lecture held at Rhode-Saint-Genese, Belgium 24-28 Apr., 1978 2 Vol.
(VKI-Lec-Ser-1978-6-Vol-2) Avail: NTIS HC A14/MF A01

Subjects discussed include recuperative gas cycles with derivation for power and heat generation, power generation, power generation with binary cycles, magnetohydrodynamics, and thermoionic conversion. For individual titles, see N79-28739 through N79-28742.

N79-28739# Commissariat a l'Energie Atomique, Saclay (France).
RECUPERATIVE GAS CYCLES WITH DERIVATION FOR POWER AND HEAT GENERATION. APPLICATION TO COMBINED CYCLES
Z. P. Tilliette *In* Von Karman Inst. for Fluid Dyn. Combined Cycles for Power Generation, Vol. 2 1978 43 p (For primary document see N79-28738 19-44)
Avail: NTIS HC A14/MF A01

Recuperative gas cycles without a by-pass steam generator are briefly reviewed. Recuperative cycles with a by-pass steam generator are discussed along with many charts and diagrams. The main advantages include high overall plant efficiency, especially for electrical generation when using combined gas-steam cycles, favorable technological conditions for steam generation, and good operational flexibility. Three examples of conditions and performances are presented corresponding to the open cycle, the fossil fuel case, and to the closed cycle with helium as the working fluid in the fossil fuel case as well as the nuclear fuel case. Author (ESA)

N79-28740# Mechanical Technology, Inc., Latham, N. Y.
POWER GENERATION WITH BINARY CYCLES
D. D. Colosimo, R. K. Rose, and O. Decker *In* Von Karman Inst. for Fluid Dyn. Combined Cycles for Power Generation, Vol. 2 1978 196 p refs (For primary document see N79-28738 19-44)
Avail: NTIS HC A14/MF A01

The state of the art in Rankine bottoming cycles is surveyed in order to illustrate the applicability of binary cycles. Selection of Rankine cycle working fluids is discussed refereing to six available commercial products. The two favorite industrial waste heat sources, gas turbines and diesel engines, are reviewed in reference to applicability to steam organic or binary cycles. Effects of governmental policies and alternative energy prices on the economics of energy recovery are discussed. Criteria for screening organic and binary cycle adaptation to industrial processes are given. Author (ESA)

N79-28741# Massachusetts Inst. of Tech., Cambridge.
MAGNETOHYDRODYNAMICS
Jean F. Louis *In* Von Karman Inst. for Fluid Dyn. Combined Cycles for Power Generation, Vol. 2 1978 64 p refs (For primary document see N79-28738 19-44)
Avail: NTIS HC A14/MF A01

Magnetohydrodynamic theory, application schemes, and an economic analysis are surveyed. A typical example of an open cycle direct preheat MHD-steam plant project is discussed. A nominal output power of 2000 MW, 7 years construction time, an overall net efficiency oof 48 percent, and other parameters are detailed. The case of oxygen enrichment and the closed cycle inert gas MHD are briefly discussed. Author (ESA)

N79-28742# Massachusetts Inst. of Tech., Cambridge.
THERMIONIC CONVERSION
Jean F. Louis *In* Von Karman Inst. for Fluid Dyn. Combined Cycles for Power Generation, Vol. 2 1974 15 p (For primary document see N79-28738 19-44)
Avail: NTIS HC A14/MF A01

The state of the art of thermionic conversion is surveyed. It is anticipated that in the next 10 years the goal of reducing the barrier index to about 1 to 1.6 electron-volts will be reached permitting a number of practical applications such as topping units for steam power plants. A 1000 MW joint General Electric and Thermo Electron Corporation project is discussed. Pulverized coal is used as fuel, with steps of thermionic conversion complemented by steam turbogenerators. Overall efficiency is 46.7 percent. Author (ESA)

N79-28743# TRW Defense and Space Systems Group, Redondo Beach, Calif.
ENERGY RECOVERY FROM ARMY AMMUNITION PLANT SOLID WASTE BY PYROLYSIS Final Report
J. D. Pinkerton, R. F. Tobias, and Robert Scola Mar. 1979 85 p refs
(Contract DAAA21-76-C-0537)
(AD-A067519; AD-E400300; ARLCD-CR-78030) Avail: NTIS HC A05/MF A01 CSCL 13/2

Army Ammunition Plants (AAP's) dispose of large quantities of solid waste by incineration, open-air burning, and landfill. There is at present no attempt at energy recovery. The present study was conducted to determine the feasibility of adapting pyrolysis technology for energy recovery from these solid wastes. Eight AAP's were surveyed to identify the types and amounts of solid waste generated. Candidate systems were evaluated to determine their suitability for this application. Safety considerations indicate that propellants, explosives and pyrotechnics (PEP) and PEP-contaminated waste with proper precautions could be handled safely by pyrolysis processes, but further work is needed to determine applicable size reduction techniques. It was determined that a 45.4 MG/d (50 TPD) plant would be sufficient to handle the largest quantity of waste generated at any AAP. Capital cost was estimated at $4.1 million and annual cost at $623,100. Based on these costs it was concluded that pyrolysis is not economically feasible at this time even under mobilization conditions. GRA

N79-28744# Naval Research Lab., Washington, D. C.
IMPROVEMENTS IN THE LEAD-ACID BATTERY FOR LOAD LEVELING APPLICATIONS Interim Report, FY 1978 Summary Report
A. C. Simon, S. M. Caulder, C. P. Wales, and R. L. Jones May 1979 27 p refs
(AD-A068990; NRL-MR-3988) Avail: NTIS HC A03/MF A01 CSCL 10/3

This report describes research conducted in FY-78 under a DOE program to improve the lead-acid battery system for load leveling at electricity-generating plants. The study has identified changes in the plate active material that occur during cycling (or service operation), viz, a progressive buildup of an electrochemically inactive PbO2 species, and the physical transformation of the active material to a structurally unfavorable coralloid form, which, if eliminated, could improve battery performance. GRA

N79-28745# Dayton Univ. Research Inst., Ohio.
NON-AQUEOUS ELECTRODE RESEARCH Interim Technical Report, 25 Oct. 1977 - 30 Sep. 1978
Michael H. Froning, William E. Moddeman, Thomas N. Wittberg, and Donald J. David Feb. 1979 71 p refs
(Contract F33615-77-C-3156; AF Proj. 2303)
(AD-A068751; UDR-TR-78-20; AFAPL-TR-79-2003) Avail: NTIS HC A04/MF A01 CSCL 09/3

This report describes work carried out in the first 12 months of a 33 month contract to characterize the passive films formed on anodes commonly used in non-aqueous battery cells, and to identify cell reaction products formed at the carbon cathode commonly used in these cells. GRA

N79-28746# Xerox Electro-Optical Systems, Pasadena, Calif.
THERMAL ENERGY STORAGE DEMONSTRATION UNIT FOR VUILLEUMIER CRYOGENIC COOLER HI-CAP UNIT

NO. 2, ADDENDUM Final Report, 1 Feb. - 31 Jul. 1978
Robert Richter Dec. 1978 45 p
(Contract F33615-75-C-2045; AF Proj. 2126)
(AD-A068816; AFAPL-TR-77-65-Add; Rept-2340-F-Add) Avail: NTIS HC A03/MF A01 CSCL 20/12

A second thermal energy unit for the High Capacity (Hi-Cap) Vuilleumier Cryogenic Cooler was built and tested. Incorporated into this unit were several design improvements consisting of the addition of a conduction heat transfer barrier between the radiation heat shield insulation and the mounting flange, modification of the O-ring seal of the insulation container, moving the hot cylinder-mounting flange interface, and changing the instrumentation. All design changes proved to be beneficial. The thermal losses that can be attributed to heat transfer through the insulation were lowered by about 8W from those of the first Hi-Cap TES unit. The inclusion of the terminal ring into the flange and separating the flange from the hot cylinder resulted in a substantial cost saving in material and machining of the components. The three, 1/16-inch diameter Inconel sheathed K calibration thermocouples performed consistently during the entire test period. The prime concern has been the discharge characteristic of the TES unit. Test data evaluation has indicated that the charging characteristic of the TES unit should be further investigated to obtain necessary information which will be required for the integration of the TES unit with the cryogenic cooler. GRA

N79-28747# California Univ., Berkeley. Lawrence Berkeley Lab.
GEOTHERMAL RESOURCE EXPLORATION ASSESSMENT AND DATA INTERPRETATION, KLAMATH BASIN, OREGON: SWAN LAKE AND KLAMATH HILLS AREA
M. Stark, N. Goldstein, H. Wollenberg, B. Strisower, and M. Hege Oct. 1978 80 p refs Presented at Klamath Basin Geothermal Assessment Steering Comm. Meeting, Berkeley, Calif., 9 Nov. 1978
(Contract W-7405-eng-48)
(LBL-8186(Draft); Conf-781190-1) Avail: NTIS HC A05/MF A01

A synthesis and preliminary interpretation of predominantly geophysical information relating to the Klamath Basin geothermal resource is presented. The Swan Lake Valley area, northeast of Klamath Falls, and the Klamath Hills area, south of Klamath Falls, are discussed in detail. Available geophysical data, including gravity, magnetic, electrical resistivity, microseismic, roving dipole resistivity, audio-magnetotelluric (AMT) and magnetotelluric (MT) data sets, are examined and reinterpreted for these areas. One- and two-dimensional modeling techniques are applied, and general agreement among overlapping data sets is achieved. DOE

N79-28748# Lockheed Missiles and Space Co., Sunnyvale, Calif.
OTEC PLATFORM CONFIGURATION AND INTEGRATION STUDY: EXECUTIVE SUMMARY Final Report
Apr. 1978 41 p refs
(Contract EC-77-C-01-4063)
(DOE/ET/4063-1; LMSC-D623756) Avail: NTIS HC A03/MF A01

Conceptual designs of ship-type and spar-type platforms for Ocean Thermal Energy Conversion (OTEC) commercial plants are presented. Comparative evaluation of six candidate platform types is made. Design guidelines for sea water, cold water pipe and position control systems are developed. Costs are presented for plants with outputs of 400 MWe (net) for operational sites of New Orleans, Hawaii, and Brazil. DOE

N79-28749# Ocean Systems, Inc., Reston, Va.
OTEC PLATFORM CONFIGURATION AND INTEGRATION STUDY. VOLUME 1: SYSTEMS ENGINEERING AND INTEGRATION Final Report
Apr. 1978 315 p refs
(Contract EC-77-C-01-4063)
(DOE/ET/4063-1-Vol-1; LMSC-D623756-Vol-1) Avail: NTIS HC A14/MF A01

The economic success of an ocean thermal energy conversion (OTEC) system is highly dependent on a platform which provides adequate support for the power system, accommodates reliably the cold water pipe, and is most cost effective. The results of a study conducted for the Department of Energy to assess six generic types of platforms to determine the most satisfactory platform for several potential sites are presented. The six platform configurations are ship, circular barge, semi-submersible, tuned sphere, submersible, and spar. These represent directional and symmetric types of platforms which operate on the surface, at the interface, and submerged. The five sites for this study were primarily New Orleans, Keahole Point (Hawaii), Brazil, and secondarily Key West and Puerto Rico. Electrical transmission of energy by submarine cable is the planned form of energy transmission for all sites except Brazil, where chemical conversion is to be the method of transmission. This study is devoted to the platform (or ocean systems) of the OTEC plant which is chiefly comprised of the hull and structure, the seawater system, the position control system, and miscellaneous support/assembly systems. The principal elements in the work breakdown structure for the commercial plants are presented. The assessment of the six platform configurations was conducted utilizing a baseline plan (100-MW(e) (Net)) and site (New Orleans) with variations from the baseline to cover the range of interested platforms and sites. DOE

N79-28750# Lockheed Missiles and Space Co., Sunnyvale, Calif.
OTEC PLATFORM CONFIGURATION AND INTEGRATION STUDY. VOLUME 3: PROJECT PLAN Final Report
Apr. 1978 15 p ref
(Contract EC-77-C-01-4063)
(DOE/ET/4063-1-Vol-3; LMSC-D623756-Vol-3) Avail: NTIS HC A02/MF A01

The characteristics which were desired in the demonstration plant are discussed and the demonstration activities for that plant are commented on. The cost, scale, and state of development of the technology the plant employs are covered. DOE

N79-28751# Department of Energy, Washington, D. C. Energy Information Administration.
HISTORIC AND FORECASTED ENERGY PRICES BY US DEPARTMENT OF ENERGY REGION AND FUEL TYPE FOR THREE MACROECONOMIC SCENARIOS AND ONE IMPORTED OIL PRICE ESCALATION SCENARIO
S. Borg and R. W. Moden Dec. 1978 38 p ref
(DOE/EIA-0102/27) Avail: NTIS HC A03/MF A01

The Energy Information Administration was requested to provide forecasts of energy prices at the DOE regional level for each year through the year 2000. Historical fuel prices for 1975, and 1976, and forecasted fuel prices for 1985 and 1990 are reported as an initial step in this process. The assumption and the methodology employed are described and results are tabulated. DOE

N79-28752# Department of Energy, Washington, D. C. Energy Information Administration.
SOLAR ENERGY POTENTIAL FOR RESIDENTIAL WATER HEATING AND SPACE HEATING IN THE 12TH CONGRESSIONAL DISTRICT OF PENNSYLVANIA. ANALYSIS MEMORANDUM
R. W. Moden, P. A. DonVito, C. A. Allen, and R. D. Stoll Dec. 1978 20 p refs
(DOE/EIA-0102/22) Avail: NTIS HC A02/MF A01

The analysis reflects local fuel prices, anticipated price escalations, climatic conditions (including the level of solar energy), building characteristics and installed solar costs. The results of the analysis indicate that solar systems are not cost competitive with conventional systems available in the District except under special circumstances. Solar systems could become marginally competitive against electric resistance units in the next few years if installed system costs were to become substantially lower than presently anticipated. DOE

N79-28753# California Univ., Livermore. Lawrence Livermore Lab.
APPLICATION OF SHALLOW SOLAR PONDS FOR INDUSTRIAL PROCESS HEAT: CASE HISTORIES
Alan B. Casamajor 16 Oct. 1978 18 p refs Presented at Symp. on Commercialization of Solar and Conservation Technol., Miami Beach, Fla., 11-13 Dec. 1978 Submitted for publication
(Contract EY-76-C-02-0016)
(UCRL-81764; Conf-781235-1) Avail: NTIS HC A02/MF A01

The shallow-solar-pond collector system is approaching commercialization. Three prototype or demonstration projects are described. A critique of each project points out the significant factors that affect the individual projects and shallow-solar-pond technology in general. Particular attention is drawn to problems encountered and solutions proposed. Possible marketing organization and strategies are discussed. DOE

N79-28754# Los Alamos Scientific Lab., N. Mex.
TROMBE WALL VS DIRECT GAIN: A COMPARATIVE ANALYSIS OF PASSIVE SOLAR HEATING SYSTEMS
William O. Wray and J. Douglas Balcomb 1979 8 p refs Presented at the 3d Natl. Passive Solar Conf., San Jose, Calif., 11-13 Jan. 1979
(Contract W-7405-eng-36)
(LA-UR-116; Conf-790106-2) Avail: NTIS HC A02/MF A01

The results of performance analysis calculations for both Trombe wall and direct gain systems in Albuquerque, New Mexico, and Madison, Wisconsin, are reported. The comparative analysis included parametric variation of fundamental design parameters including building load, glazing area, total mass, mass thickness, number of glazings, night insulation value and allowable temperature swing. Thermal comfort within the two generic types of buildings was considered as well as energy efficient performance. DOE

N79-28755# Los Alamos Scientific Lab., N. Mex.
APPLICATIONS OF DOE-1 TO PASSIVE SOLAR HEATING OF COMMERCIAL BUILDINGS: PRELIMINARY RESULTS
B. D. Hunn, N. M. Schnurr, J. L. Peterson, J. F. Kerrisk, and J. E. Moore 1979 6 p refs Presented at the 3d Natl. Passive Solar Conf., San Jose, Calif., 11-13 Jan. 1979 Submitted for publication
(Contract W-7405-eng-36)
(LA-UR-79-72; Conf-790106-6) Avail: NTIS HC A02/MF A01

The DOE-1 building energy analysis computer program was modified to include analysis of passive solar and large thermal mass heating and cooling systems. SUNSPOT is a detailed thermal network computer program developed for direct gain systems as a reference analysis tool to compare with the DOE-1. It was validated by comparison of calculated results with experimental test cell data. A series of runs was then made to determine the sensitivity of solar fraction to type of glazing, location and quantity of mass, and method of computing infrared radiant interchange among inside surfaces. Simulations using DOE-1 in its present form indicate that the weighting factors used in the program are not satisfactory for large mass/direct gain systems. However, it does appear that the weighting factor approach can be retained if an efficient method of determining weighting factors appropriate to passive systems can be developed. DOE

N79-28756# Los Alamos Scientific Lab., N. Mex.
PERFORMANCE AND COST OF A HYBRID PASSIVE/ACTIVE SOLAR HOUSE
B. D. Hunn 1979 26 p refs Presented at the ASHRAE Symp. on Air Infiltration, Philadelphia, Jan. 1979
(Contract W-7405-eng-36)
(LA-UR-78-2209; Conf-790112-4) Avail: NTIS HC A03/MF A01

The design, construction, cost, and initial operation of a hybrid passive/active solar heated house in Los Alamos, New Mexico, is described. The system is dominated by a two-story Trombe wall, constructed of 0.3 m thick (1 ft) slump block, that can be operated in either a passive or active mode. In the active mode, a blower circulates air through the Trombe wall air space and into a rock bed. A three zone forced air distribution system is connected to the rock bed. A separate flat plate collector array heats a preheater tank for domestic hot water. Operating results of the system are reported for just over the first year of operation. In addition, system cost, occupant observations, and conclusions are presented. Energy consumption records indicate that approximately 60% of the net space heating load was provided by solar energy. DOE

N79-28757# Lincoln Lab., Mass. Inst. of Tech., Lexington.
PHOTOVOLTAIC/THERMAL COLLECTORS AND HEAT PUMPS
Edward C. Kern, Jr. 1978 14 p refs Presented at Meeting of the Am. Sect. of the Intern. Solar Energy Soc., Denver, 28 Aug. 1978
(Contract EG-77-S-02-4577)
(COO-4577-2; Conf-780808-26) Avail: NTIS HC A02/MF A01

A simple solar-heating system comprised of an idealized heat pump and photovoltaic/thermal energy collectors is described and its performance characteristics analyzed. The mathematical model expresses the system's heating capacity as a function of insolation, ambient air temperature, and thermal-energy storage temperature. Using a closed-form solution, the system's overall efficiency is presented and compared to the efficiency of a conventional solar heating system. DOE

N79-28758# Brookhaven National Lab., Upton, N. Y.
DEVELOPMENT OF A SOLAR ASSISTED HEAT PUMP FOR THE HEATING AND COOLING OF BUILDINGS
Edward A. Kush 1978 3 p refs Presented at 3d Ann. Solar Heating and Cooling R and D Contractors' Meeting, Washington, D. C., 24 Sep. 1978
(Contracts EY-76-C-02-0016; EG-78-C-03-1719; EG-78-C-03-1720; EG-78-C-03-1718)
(BNL-24997; Conf-780983-13) Avail: NTIS HC A02/MF A01

The conceptual and detailed design, analysis, fabrication and test of heat pumps to be used effectively in solar heating and cooling systems sized for residential, multifamily, and commercial building applications (1 to 25 tons) are reported. These high performance heat pumps efficiently utilize in-line solar input in the temperature range of 40 to 100 F in the heating mode. They are interfaced with related components to reduce system configuration optimized for energy conservation and cost effectiveness with the goal of realistic competition with conventional space conditioning systems. Marketing studies accompanying the development of the prototype hardware provide direction for attaining this goal and an expeditious transition from the present R and D work to production and commercialization.DOE

N79-28759# Battelle Pacific Northwest Labs., Richland, Wash.
NUMERICAL ANALYSIS OF TEMPERATURE AND FLOW EFFECTS IN A DRY, ONE-DIMENSIONAL AQUIFER USED FOR COMPRESSED AIR ENERGY STORGE
G. C. Smith, L. E. Wiles, and W. V. Loscutoff Feb. 1979 97 p refs Revised
(Contract EY-76-C-06-1830)
(PNL-2546; PNL-2443-Rev) Avail: NTIS HC A05/MF A01

A description of the method of analysis and the results obtained for an investigation of the hydrodynamic and thermodynamic response of a model of a dry porous media reservoir used for compressed air energy storage is presented. Results were obtained from a one dimensional simulation of the cycling of heated air to and from a radial flow field surrounding a single well in a porous rock. The performance of the bulk of the reservoir was assumed to be characterized by the performance of a single well. DOE

N79-28760# Sandia Labs., Albuquerque, N. Mex.
VARIABLES AFFECTING THERMAL CELL AND BATTERY PERFORMANCE
S. C. Levy and S. S. Morimoto Jan. 1979 24 p refs
(Contract EY-76-C-04-0789)
(SAND-77-2011) Avail: NTIS HC A02/MF A01

The effect of closing force on thermal battery performance was studied. Tests were conducted with single cells, by use of a tester which fixes the stack height dimension on the cell and allows changes in pressure during discharge to be monitored, and with a five cell battery, especially designed to measure pressure on the cell stack stack during discharge. Pressure variations were studied as a function of pellet desnity, initial stack pressure, composition, and current density. Also, the effect of pressure on capacity and excess alloy was investigated. In all cases, most of the initial pressure on the cells and batteries was lost upon activation. Some differences between single cells and batteries were noted in the pressure profile and performance as the above parameters were varied. These differences are attributed to a varying temperature in the battery versus a constant temperature in the single-cell tests and springlike

insulation at the ends of the battery stack versus a rigid single-cell test fixture. DOE

N79-28761# California Univ., Berkeley. Lawrence Berkeley Lab.
MASS TRANSFER CONTROLLED REACTIONS IN PACKED BEDS AT LOW REYNOLDS NUMBERS
P. S. Fedkiw Dec. 1978 258 p refs
(Contract W-7405-eng-48)
(LBL-8509) Avail: NTIS HC A12/MF A01

Packed-bed data for the mass-transfer rate at low Reynolds numbers were sparse, especially in liquid systems. The velocity field in such a tube should be a good approximation to the converging-diverging character of the velocity field in an actual bed. The creeping flow velocity profiles were calculated. These results were used in the convective-diffusion equation to find mass transfer rates at high Peclet number for both deep and shallow beds, for low Peclet numbers in a deep bed. All calculations assumed that the reactant concentration at the tube surface is zero. Mass transfer data were experimentally taken in a transport controlled, flow through porous electrode to test the theoretical calculations and to provide data recently unavailable for deeper beds. All data was described by a model which incorporates a channeling effect. The bed was successfully modeled as an array of dual sized straight tubes. DOE

N79-28762# Sandia Labs., Albuquerque, N. Mex.
OVERVIEW OF SOLAR SYSTEM DESIGN AND APPLICATION PRINCIPLES
V. L. Dugan 1979 11 p refs Presented at the Solar Energy Symp., Tokyo, 5 Feb. 1979
(Contract EY-76-C-04-0789)
(SAND-78-2419C; Conf-790203-1) Avail: NTIS HC A02/MF A01

Solar thermal energy conversion systems repres. ' a method of reducing dependency on stored energy reserves; this is done at the expense of an increased dependency on materials and land resources. The various technologies being investigated to convert solar radiation into thermal energy are reviewed, and general guidelines which should be followed in designing and applying cost-effective solar conversion systems are presented. This information is expanded upon and illustrated by a comparison of performance results for a range of solar thermal technologies and by one solar irrigation application in the United States. DOE

N79-28763# Battelle Pacific Northwest Labs., Richland, Wash.
HELIOSTAT MANUFACTURING ANALYSIS
Kirk Drumheller 1 Oct. 1978 155 p refs
(Contract EY-76-C-06-1830)
(PNL-2757) Avail: NTIS HC A08/MF A01

The manufacturing analysis provided materials, labor, equipment, and facility costs for each step in the manufacturing process. Detailed procedures are presented for cost estimates. These include estimating worksheets for each component of the manufacturing costs. DOE

N79-28764# Franklin Inst., Philadelphia, Pa.
SELF CONTROLLING, SELF PUMPING HEAT CIRCULATING SYSTEM STUDY Progress Report, 1 Aug. 1977 - 31 Jan. 1978
G. P. Wachtell Jun. 1979 5 p refs Presented at the Workshop on the Control of Solar Energy, Hyannis, Mass., 23 May 1978
(Contract EG-77-C-02-4484)
(COO-4484-03; Conf-7805126-6) Avail: NTIS HC A02/MF A01

Several self pumping devices for transporting heat from roof-mounted solar collectors to thermal energy storage (TES) at a lower elevation are described and given a preliminary evaluation. The work included a literature search with acquisition of many documents. A peak heat load of 75,000 Btu/hr with collector outlet temperature between 120 and 160 F was assumed, representing the use of flat plate collectors on a single-family dwelling. DOE

N79-28765# Northeast Solar Energy Center, Cambridge, Mass.
BARRIERS AND INCENTIVES TO SOLAR ENERGY DEVELOPMENT. AN ANALYSIS OF LEGAL AND INSTITUTIONAL ISSUES IN THE NORTHEAST
Arnold R. Wallenstein Dec. 1978 115 p
(Contract EM-78-C-01-4274)
(NESEC-1) Avail: NTIS HC A06/MF A01

The legal and institutional barriers and incentives to commercializing alternate energy sources are analyzed with particular emphasis on solar energy. The laws that constitute either legal barriers or possible incentives in the commercializing of solar energy in the nine states served by the Northeast Solar Energy Center are detailed. Each barrier or incentive is briefly described in conceptual terms and then each issue area is analyzed in detail, within the context of the law of the nine states in the region. An analysis is given of Federal patterns of spending and subsidy. The section also addresses life-cycle costing, the problem of obtaining loans and insurance, DOE patent regulation issues, and briefly describes potential Federal and state financial sources for solar energy development. Laws in the nine-state region that address product and tort liability, warranty protection, consumer credit, consumer protection, trade and business regulation statutes, and equipment certification and product standards problems are discussed. Zoning, land use, sun and wind access, and building codes and inspection problems are included. Public utility regulations, state energy solar office enabling legislation, and labor jurisdiction questions are covered. DOE

N79-28766# Garrett Energy Research and Engineering Co., Ojai, Calif.
THERMOCHEMICAL CONVERSION: BIOMASS GASIFICATION
D. E. Garrett 1978 16 p refs
(Contract EY-76-C-03-1241)
(TID-29391) Avail: NTIS HC A02/MF A01

The thermal conversion of biomass into medium Btu gas is being studied in process development units of the multiple hearth type. The operation of the PDU is described and a process description is given. Significant findings with respect to the steam-carbon reaction rates, stability of the hydrocarbon gases, and direct contact drying of manure are summarized. DOE

N79-28767# Gibbs and Cox, Inc., Washington, D. C.
OCEAN THERMAL ENERGY CONVERSION (OTEC) PLATFORM CONFIGURATION AND INTEGRATION. VOLUME 1: SYSTEMS REQUIREMENTS AND EVALUATION Final Report
Jun. 1978 415 p refs
(Contract EG-77-C-01-4064)
(DOE/ET/4064-1-Vol-1) Avail: NTIS HC A18/MF A01

Studies leading to the development of two 400 MW offshore thermal energy conversion commercial plants are presented. This volume includes a summary of three tasks: task 2A-systems evaluation and requirements; task 2B-evaluation plan; task 3-technology review; and task 4-systems integration evaluation. Task 2A includes the definition of top level requirements and an assessment of factors critical to the selection of hull configuration and size, quantification of payload requirements and characteristics, and sensitivity of system characteristics to site selection. Task 2B includes development of a methodology for systematically evaluating the candidate hullforms, based on interrelationships and priorities developed during task 2A. Task 3 includes the assessment of current technology and identification of deficiencies in relation to OTEC requirements and the development of plans to correct such deficiencies. Task IV involves the formal evaluation of the six candidate hullforms in relation to site and plant capacity to quantify cost/size/capability relationships, leading to selection of an optimum commercial plant. DOE

N79-28768# Sandia Labs., Albuquerque, N. Mex.
INSOLATION MODELING OVERVIEW
E. C. Boes Dec. 1978 18 p refs
(Contract EX-76-C-04-0789)
(SAND-78-0963) Avail: NTIS HC A02/MF A01

Some of the major national projects in the solar radiation resource assessment area are summarized. Historical SOLMET solar data tapes are described, including the solar radiation models used in their development. Recommendations for appropriate data sources for solar system simulations are given. DOE

N79-28769# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ECONOMICS OF SOLAR PHOTOVOLTAIC ENERGY SYSTEMS FOR CROP IRRIGATION IN THE UNITED STATES
R. W. Matlin and M. T. Katzman (Texas Univ. at Dallas, Richardson) 1978 12 p refs Presented at the Atelier Pompage Solaire, Perpignam, France, 3 Jul. 1978
(Contract EY-76-C-02-4094)
(COO-4094-29; Conf-780773-2) Avail: NTIS HC A02/MF A01

In the United States, the majority of the energy for pumping water is used over extremely large areas (160-acre quarter sections), requiring large pumping units (100 to 300 kW peak power). Additionally, the American farmer has traditionally had access to low-cost energy. An economic analysis of the profitability of adopting solar photovoltaic energy systems for such situations was undertaken. The basis for this analysis is presented along with a discussion as to the time of initial profitability, the time of optimal investment, the effects of the tax system, the cost per acre that would make irrigation inviable, and possible governmental incentives that would promote the deployment of photovoltaic irrigation systems between the time of initial profitability and the time of optimal investment. DOE

N79-28770# Texas Univ. at Austin. Center for Energy Studies.
TESTING AND SAMPLING PROCEDURES FOR GEOTHERMAL-COMPRESSED WELLS Final Report
W. E. Boyd [1978] 155 p
(Contract EY-76-S-05-5243)
(UT/CES-GR-2) Avail: NTIS HC A08/MF A01

Test wells to tap and sample geothermal-geopressured formations at 15,000 to 20,000 feet in the Gulf Coast area can be drilled routinely utilizing available equipment and methods. Electrical logs, surveys and fluid samplers can be used to obtain accurate and reliable information as to depths, temperatures, pressures, and fluid content of the geopressured formations before the well is completed. But it will be necessary to set casing and flow the well, at least temporarily, to secure fluid production volume and pressure data to evaluate the producibility of the geopressured resource. Electric logging and wireline survey methods are fully developed techniques for measuring the parameters needed to assess a geopressured zone before setting casing. Formation subsidence, though it may be slow to develop, can be measured during radioactivity tracer surveys. The following conclusions are drawn: existing well logging and surveying methods and equipment are generally satisfactory for testing and sampling a geothermal-geopressured resource; no significant areas of research are needed to predict, detect, and evaluate geopressured formations for their potential as geothermal resources. Static and dynamic testing procedures using existing technology are satisfactory to test, sample, and analyze a geopressured reservoir. DOE

N79-28771# Department of Energy, Washington, D. C. Div. of Solar Applications Developments.
SOLAR HEATING AND COOLING DEMONSTRATION PROJECT SUMMARIES
Jan. 1979 319 p refs
(DOE/CS-0038-2) Avail: NTIS HC A14/MF A01

The demonstration program includes commercial and residential-type buildings sponsored by DOE alone, or jointly with other Federal agencies, city and state governments, and private agencies. The commercial projects include a wide variety of building types, such as: office buildings, schools, fire stations, civic centers, factories, and libraries. Residential projects include both single and multifamily dwellings of various configurations. Approximately 200 projects will be instrumented to measure the performance of the solar systems. Analysis of the collected data will provide definitive guides for design criteria and permit realistic economic assessment of various solar systems. The demonstrations are discussed in three sections: commercial demonstration program-non-federal buildings; commercial demonstration program-federal buildings; and residential demonstration program-federal buildings. Maps showing the locations (by state) of the buildings are provided at the beginning of each section along with an index that identifies each project and page number for the corresponding descriptive information. A map depicting the distribution of all demonstration projects is included in this introduction. The comparable map from last year's publication is also shown to depict the increase in the number of projects. The contents of this document are based on information available as of November 1, 1978. DOE

N79-28772# Radian Corp., Austin, Tex.
MATERIALS SELECTION GUIDELINES FOR GEOTHERMAL POWER SYSTEMS. FIRST EDITION
David W. DeBerry, Peter F. Ellis, and Colin C. Thomas Sep. 1978 319 p refs
(Contract EG-77-C-04-3904)
(ALO-3904-1; DCN-78-200-181-17) Avail: NTIS HC A14/MF A01

Nine potential power cycles are defined and diagrammed for the generation of electricity from geothermal fluids. General fluid properties that influence the applicability of power cycles to a particular geothermal resource are discussed. The corrosivity of individual process streams in power cycles is described based on variation in chemical composition and temperature. Results of materials performance tests are analyzed based on the chemical composition of the corrosive medium and physical factors such as temperature, duration of exposure, and fluid velocity. The key chemical components in geothermal fluids that are significant in determining corrosivity are identified. Both summarized and detailed results of materials performance tests in U.S. liquid-dominated resources are given. Seven U.S. liquid-dominated KGRA's are classified according to relative corrosiveness and their key chemical components are defined. The various forms and mechanisms of corrosive attack that can occur in geothermal process streams are described. The application of nonmetallic materials in geothermal environments is reported. DOE

N79-28773# Los Alamos Scientific Lab., N. Mex.
ELECTRICITY FROM HOT DRY ROCK GEOTHERMAL ENERGY: TECHNICAL AND ECONOMIC ISSUES
Jefferson W. Tester , Glenn E. Morris , Ronald G. Cummings (N. Mex. Univ., Albuquerque), and Robert L. Bivins Jan. 1979 27 p refs
(Contract W-7405-eng-36)
(LA-7603-MS) Avail: NTIS HC A03/MF A01

Extraction of energy from hot dry rock would make available a nearly unlimited energy source. Some of the technical problems and possible economic tradeoffs involved in a power generating system are examined and possible solutions proposed. An intertemporal optimization computer model of electricity production from a hot dry rock geothermal source has been constructed. The effects of reservoir degradation, variable fluid flow rate, and drilling operations are examined to determine optimal strategies for reservoir management and necessary conditions for economic feasibility. DOE

N79-28774# California Univ., Livermore. Lawrence Livermore Lab.
DESIGN GUIDE FOR SHALLOW SOLAR PONDS
A. B. Casamajor and R. E. Parsons 8 Jan. 1979 65 p refs Revised
(Contract W-7405-eng-48)
(UCRL-52385-Rev-1) Avail: NTIS HC A04/MF A01

The three aspects of Shallow Solar Ponds (SSP) technology discussed include: (1) an introduction to SSP technology, potential, and limitations; (2) a description of the design and operation of an SSP system including component drawings and specifications; and (3) planning information so that an SSP system can be sized for particular application and the cost can be estimated. DOE

N79-28775# Oak Ridge National Lab., Tenn.
GAS-STEAM TURBINE COMBINED CYCLE POWER PLANTS
Jeffrey E. Christian Oct. 1978 68 p refs
(Contract W-31-109-eng-38)
(ANL/CES/TE-78-4) Avail: NTIS HC A04/MF A01

Performance and cost characteristics of the combined gas and steam turbine cycle system applied to an Integrated Community Energy System (ICES) are given. The basic gas-steam turbine combined cycle consists of: (1) a gas turbine-generator set; (2) a waste-heat recovery boiler in the gas turbine exhaust

stream designed to produce steam; and (3) a steam turbine acting as a bottoming cycle. Because modification of the standard steam portion of the combined cycle would be necessary to recover waste heat at a useful temperature some sacrifice in the potential conversion efficiency is necessary at this temperature. The total energy efficiency varies from about 65 to 73 percent at full load to 34 to 49 percent at 20 percent rated electric power output. Two major factors considered when installing a gas-steam turbine combines cycle are the realiability of the gas turbine portion of the cycle, and the availability of liquid and gas fuels or the feasibility of hooking up with a coal gasification/liquefaction process. DOE

N79-28776# Oak Ridge National Lab., Tenn. Engineering Technology Div.

COMPARATIVE EVALUATION OF RECENT REPORTS ON THE ENERGY CONSERVATION POTENTIAL FROM COGENERATION

R. W. Barnes (Dow Chemical USA, Midland, Mich.) and O. H. Klepper Feb. 1979 48 p refs

(Contract W-7405-eng-26)

(ORNL/TM-6602) Avail: NTIS HC A03/MF A01

Most of the electricity generated in the U.S. and the heat used by industry, buildings, and homes are produced independently from the combustion of separate fuels. Cogeneration, the combined production of electricity and useful heat, could reduce significantly the total amount of fuel required. This report discusses areas of application and alternative technologies for cogeneration. Projections by various investigators indicate potential U.S. energy savings from 1 to 2 percent up to almost 10 percent. Several of the published estimates of potential energy conservation benefits from cogeneration are analyzed and reduced to common bases for comparison. Significiant differences in the various projections arise from differences in estimating the size of the industrial steam demand and from divergent assumptions concerning the tractability of various implementation problems. DOE

N79-28777# Argonne National Lab., Ill. Energy and Environmental Systems Div.

COST STUDY APPLICATION OF THE GUIDEBOOK ON INTEGRATED COMMUNITY ENERGY SYSTEMS: INDIRECT ECONOMIC AND ENERGY IMPACTS

Nov. 1978 31 p

(Contract W-31-109-eng-38)

(ANL/ICES-TM-17) Avail: NTIS HC A03/MF A01

An integrated community energy system (ICES) was considered for a community located in a small New England city. The ICES involves substitution of energy forms as well as modification of fuel requirements. Examination of the integrated system, in comparison with existing energy systems, includes both indirect economic impacts (employment and fiscal effects on the city) and indirect energy impacts. The indirect economic analysis proceeds from an initial description of conditions that determine employment and fiscal results through specific estimates of employment and then revenues and costs to municipal government and finally to an evaluation of ICES's worth to the city. The indirect energy analysis compares energy resource requirements of the ICES with those for gas, oil, and electric systems now serving the community. DOE

N79-28778# Development Sciences, Inc., East Sandwich, Mass.

GUIDEBOOK ON INTEGRATED COMMUNITY ENERGY SYSTEMS: INDIRECT ECONOMIC AND ENERGY IMPACTS

Nov. 1978 79 p refs

(Contract W-31-109-eng-38)

(ANL/ICES-TM-16) Avail: NTIS HC A05/MF A01

Descriptions of how indirect impacts of energy systems can be estimated are presented so that various members of the community can understand them and participate in the energy-related decisions. DOE

N79-28779# Brookhaven National Lab., Upton, N. Y.

APPLICATION OF RESOURCE ALLOCATION MODELS TO THE PROBLEMS OF REGIONAL ENERGY POLICY IN LARGE DEVELOPING COUNTRIES

P. M. Meier and V. Mubavi 4 Jan. 1979 35 p refs Presented at Intern. Seminar on Energy, Hyderabad, India, 4-7 Jan. 1979

(Contract EY-76-C-02-0016)

(BNL-25537; Conf-790134-1) Avail: NTIS HC A03/MF A01

This paper explores the applicability of optimal resource allocation models designed primarily for already-developed economies, such as that of the U.S., Canada, and Western Europe, to the emerging problems of such developing countries was presented. The potential application of electric-utility-siting models is discussed in the context of electric grid expansion in the State of Andhra Pradesh in Southern India. Specific topics addressed include the degree to which models can be effectively used in the rather different conditions and priorities of industrializing countries; the requirements for basic-model reformulations to account for unique factors of geography and the ability to include and quantify environmental impacts of energy development as well as policy considerations relevant in the context of developing countries. DOE

N79-28780# Argonne National Lab., Ill.

ELECTRIC RATES FOR COMMERCIALIZING THERMAL STORAGE IN BUILDINGS

J. Asbury and L. Holt 1978 14 p refs Presented at Symp. on Commercialization of Solar and Conservation Technol., Miami Beach, Fla., 11 Dec. 1978

(Contract W-31-109-eng-38)

(CONF-781235-2) Avail: NTIS HC A02/MF A01

The economic benefits are described of thermal storage in residential buildings, and alternative electric-rate designs to commercialize thermal-storage technologies are analyzed. Storage in three residential applications are considered: electric storage heating, storage air conditioning, and storage domestic water heating. The storage systems collect off-peak electric energy for thermal applications during peak-load hours. The economic rationale for the systems is that the marginal cost of utility-supplied energy is considerably lower during off-peak hours than during on-peak hours. The design and implementations of effective electric rates is the key to commercializing the storage technologies. Four types of rates are evaluated: time-of-use rates, demand charges, and two forms of load management contract rates (a monthly credit and an off-peak discount). The criteria used to evaluate the rates are: combined utility and customer benefits (efficiency), political acceptability, simplicity, and practical feasibility. Alternative rate types are evaluated and findings are presented for each storage application. DOE

N79-28781# Delegationen foer Energiforskning, Stockholm (Sweden).

ENERGY RESEARCH AND DEVELOPMENT IN SWEDEN, 1978-1981

T. Josefsson and L. Ellwerth Sep. 1978 33 p refs

(DFE-13) Avail: NTIS (US Sales Only) HC A03/MF A01; DOE Depository Libraries

The objectives, structure, budget, and organization of the three year program are described. The programs and subprograms are: energy use in industrial process (general studies, wood, pulp, paper, iron, steel, agriculture, horticulture, recycling, and recovery); energy use for transportation (transportation systems, energy use in vehicles); energy use for buildings (energy conservation, heat pumps, solar heating systems and solar energy storage, planning and control mechanisms, statistics, consumer requirements, planning and evaluation of experimental building activities); energy supply (domestic fuel sources, coal, synthetic fuels, light water reactors, hot water heating, wind energy, advanced energy technology, fusion). Funds for general energy system studies, fundamental research, planning and coordination, and international cooperation and other efforts related to the main program are indicated. DOE

N79-28782# Department of Energy, Washington, D. C. Office of Consumer Affairs.

ENERGY AND URBAN POLICIES/PROGRAMS: OFFICIAL TRANSCRIPT OF PUBLIC BRIEFING AND ADDENDUM, 27 APRIL 1978, WASHINGTON, D. C.

Feb. 1979 163 p

(DOE/IR-0042) Avail: NTIS HC A08/MF A01

Sixty-one questions are indexed that were raised relative to the DOE public briefing on Energy and Urban Policies/Programs. Questions 1 through 40 were submitted by consumer and public

interest groups prior to the briefing and answered by DOE program offices. With Ms. Tina Hobson as moderator, the speakers and panelists answered some of the questions in their presentations. Those presenting speeches were Dr. James Schlesinger, Sam Hughs, Alvin Alm, Donald A. Beattie, William Peacock, Fr. Geno C. Baroni, Walter Jabzanka. Three additional questions were read into the official record of the proceedings at the conclusion of the public briefing. Their answers were prepared by DOE program offices. Author (DOE)

N79-28783# Lincoln Lab., Mass. Inst. of Tech., Lexington.
CONCEPTUAL DESIGN OF A PACKED BED FOR THERMAL-ENERGY STORAGE
Nigel I. Hamilton 20 Dec. 1978 56 p refs
(Contract EX-76-A-01-2295)
(CAES-10) Avail: NTIS HC A04/MF A01

The design approach, conceptual design, and basic cost estimates for a packed bed for thermal-energy storage in an underground compressed-air-storage system are presented. The conceptual designs considered are a 200 MW(e) system operating on a weekly cycle, and a combined solar-thermal/compressed-air-storage system capable of delivering 100 MW(e) to the generator on discharge. Geological stresses in the thermal-energy storage cavity are examined. DOE

N79-28784# Los Alamos Scientific Lab., N. Mex.
DATA ACQUISITION FOR THE HOT DRY ROCK GEOTHERMAL ENERGY PROJECT
Robert G. Lawton and Everett H. Horton 1979 7 p refs Presented at 25th Intern. Instrumentation Symp., Anaheim, Calif., 7-10 May 1979
(Contract W-7405-eng-36)
(LA-UR-79-812; Conf-790505-2) Avail: NTIS HC A02/MF A01

The data acquisition system for the Hot Dry Rock Geothermal Energy Project at Fenton Hill, in northern New Mexico, evolved to a computer controlled system complete with visual displays and emergency alarms. The system is comprised of two units. One unit monitors all surface facilities and during an energy extraction experiment is on-line 24 h a day. The other system is used for specialized downhole experiments. The data acquisition system is operator oriented so that a minimum crew can maintain the system. DOE

N79-28785# Sandia Labs., Albuquerque, N. Mex.
LOW-TEMPERATURE PERFORMANCE COMPARISONS OF PARABOLIC-TROUGH AND FLAT-PLATE COLLECTORS BASED ON TYPICAL METEOROLOGICAL YEAR DATA
George W. Treadwell Feb. 1979 32 p refs
(Contract EY-76-C-04-0789)
(SAND-78-0965) Avail: NTIS HC A03/MF A01

Performance calculations were made to compare the performance of orientations of parabolic-trough collectors with those of single-cover flat-plate collectors. Typical meteorological year weather inputs were used. Results indicate performance advantages of the horizontal north-south-axis parabolic-trough collectors over most areas of the United States. DOE

N79-28786# Los Alamos Scientific Lab., N. Mex.
LOW TEMPERATURE FLAT-PLATE COLLECTOR SPACE/WATER HEATING
S. W. Moore 1978 6 p refs Presented at Reliability of Mater. for Solar Energy Systems Workshop, Denver, 18-20 Dec. 1978
(Contract W-7405-eng-36)
(LA-UR-79-585; Conf-781228-2) Avail: NTIS HC A02/MF A01

Low temperature flat plate collector designs can take many different forms and make use of a variety of materials. Collectors can be liquid heaters, air heaters, heat-pipe exchanged, or a hybrid arrangement when combined with passive systems. They can be factory-manufactured modules, site assembly of factory-manufactured components, factory-manufactured into transportable housing, or completely site-constructed. Material selection for all components must be evaluated with respect to operating parameters, performance, durability, and above all, life-cycle costing. DOE

N79-28787# Department of Energy, Washington, D. C. Energy Information Administration.
SOLAR COLLECTOR MANUFACTURING ACTIVITY Energy Data Report, Jul. 1977 - Jun. 1978
Feb. 1979 50 p refs
(DOE/EIA-0174) Avail: NTIS HC A03/MF A01

Solar collector manufacturing activity is presented in tabular form by geographic location, producer size, collector type, end use, and type of user. Producer shipments of solar collectors increased more than 1 million square feet (20.6 percent) over the shipments reported for six months prior. The number of manufacturers reporting sales remained relatively stable. Consequently, the statistics reflect an increase in production per company. A list of the manufacturers responding to the survey is included. DOE

N79-28788# Mueller Associates, Inc., Baltimore, Md.
SOLAR PROJECT COST REPORT
H. J. Hale 1978 30 p
(Contracts W-31-109-eng-38; EG-77-C-01-4049)
(SOLAR/2018-78/60) Avail: NTIS HC A03/MF A01

A cost information for the Reedy Creek Utilities solar space heating, cooling and service water heating project located in Walt Disney World, Florida is presented. The solar energy system cools, heats and supplies service hot water for approximately 5624 square feet of office space in a general office building. The system was designed as an integral part of the building at the time the building was designed. The construction costs of this solar project are presented in this report. Category costs are listed by materials, direct labor, and subcontract costs. The subcontract costs include both materials, labor, overhead and profit for electrical, control and other minor subcontractors. DOE

N79-28789# International Business Machines Corp., Huntsville, Ala.
SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION
C. T. Wallace, A. R. Brooks, and L. J. Murphy 1978 43 p refs
(Contracts EG-77-C-01-4049; EX-76-C-01-2401)
(SOLAR/2018-78/14) Avail: NTIS HC A03/MF A01

A summary of the March through August 1978 operation of the Reedy Creek Utility District solar energy system is presented. This system was designed to provide space heating and cooling as well as hot water for a two story modern office building located in Lake Buena Vista, Florida. Results of an evaluation of measured system performance and a comparison of measured climatic data with long term average conditions are presented. Performance evaluations of each of the major subsystems are also presented. DOE

N79-28790# Los Alamos Scientific Lab., N. Mex.
SOLAR HEATING AND COOLING RESULTS FOR THE LOS ALAMOS STUDY CENTER
J. C. Hedstrom, H. S. Murray, and J. D. Balcomb 1978 7 p ref Presented at Conf. on Solar Heating and Cooling Systems Operational Results, Colorado Springs, Colo., 28 Nov. - 1 Dec. 1978
(Contract W-7405-eng-36)
(LA-UR-78-2588; Conf-781236-1) Avail: NTIS HC A02/MF A01

From Conference on solar heating and cooling systems operational results; Colorado Springs, Co, USA (28 Nov 1978). The solar energy system for the Study Center consists of an 8000 sq ft array of selectively coated, single-glazed collectors, a 5000 gallon pressurized tank for hot storage in the cooling mode, and a 10,000 gallon tank, which is used for hot storage in the heating mode and cold storage in the cooling mode. Either of two chillers may be used in series with the cold storage tank, an 85 ton absorption unit, or a 77 ton Rankine cycle unit. Night evaporative cooling is also used to cool the 10,000 gallon tank. A heat recovery unit is used to preheat fresh air in the winter, and, by means of spraying the exhaust air, to pre-cool fresh air in the summer. Daily, monthly, and seasonal energy summaries are presented for the system. Performance data for the two chillers include tabulation of thermal and system coefficients of performance. DOE

N79-28791# Public Service Co. of New Mexico, Albuquerque.
TECHNICAL AND ECONOMIC ASSESSMENT OF SOLAR HYBRID REPOWERING Final Report
Sep. 1978 572 p refs
(Contract EG-77-C-03-1608)
(SAN-1608-4-1) Avail: NTIS HC A24/MF A01

The study presented was divided into the six primary tasks to allow a systematic investigation of the concept: (1) market survey and cost/benefit analysis; (2) study unit selection, (3) cost estimates; (4) unit economic analysis, (5) program planning, future phases, and (6) program management. Reeves Station No. 2 at Albuquerque, New Mexico, was selected for repowering with a design goal of 50 percent (25 MWe). The solar system design is based on the 10 MW solar central receiver pilot plant preliminary design for Barstow, California. DOE

N79-28792# Radian Corp., McLean, Va.
COMPARISON OF ATMOSPHERIC FLUIDIZED BED COMBUSTION CONCEPTUAL DESIGNS FOR UTILITY STEAM GENERATION Interim Report
Feb. 1979 134 p refs
(Contract EX-76-A-01-2314)
(HCP/T-2314) Avail: NTIS HC A07/MF A01

The information developed to date under the AFBC conceptual design project was reviewed to obtain a clear delineation of the state-of-the art and technical feasibility of the technology and to develop a design on which to base an economic analysis of the technology. Three main conceptual designs for utility AFBC electric power generating plants were prepared under this program. Much of the merit of this effort is that the boilers were designed by established boiler manufacturers and the balance of the power plants designed by highly experienced architect-engineering firms. At present, the initial conceptual designs for the AFBC plants were completed. DOE

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N79-28793 Rochester Univ., N. Y.
DIFFUSION MEASUREMENTS OF AEROSOLS Ph.D. Thesis
Sidney Case Soderholm 1979 135 p
Avail: Univ. Microfilms Order No. 7914505

A review is given of the theoretical results and data analysis techniques which have been used in diffusion measurements of aerosols. Most measurements consisted of determining the aerosol concentration downstream of each of several diffusion cells in a diffusion battery. New and accurate theoretical expressions for the penetration of circular tube and parallel plate diffusion cells are extracted from the literature. The construction of a silver aerosol generator, the design of a diffusion collector, the assembling of an aerosol monitoring system, and the collection of data are detailed. Two samples analyzed in detail verify the theory of operation of the diffusion collector and reveal unexpected properties of the silver aerosol which could not have been positively demonstrated by previous diffusion measurement techniques. Dissert. Abstr.

N79-28794*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A REGRESSION TECHNIQUE FOR EVALUATION AND QUANTIFICATION FOR WATER QUALITY PARAMETERS FROM REMOTE SENSING DATA
Charles H. Whitlock and Chin Y. Kuo (Old Dominion Univ., Norfolk, Va.) May 1979 17 p refs Presented at 13th Intern. Symp. on Remote Sensing of the Environ., Ann Arbor, Mich., 23-27 Apr. 1979
(NASA-TM-80101) Avail: NTIS HC A02/MF A01 CSCL 13B

The objective of this paper is to define optical physics and/or environmental conditions under which the linear multiple-regression should be applicable. An investigation of the signal-response equations is conducted and the concept is tested by application to actual remote sensing data from a laboratory experiment performed under controlled conditions. Investigation of the signal-response equations shows that the exact solution for a number of optical physics conditions is of the same form as a linearized multiple-regression equation, even if nonlinear contributions from surface reflections, atmospheric constituents, or other water pollutants are included. Limitations on achieving this type of solution are defined. F.O.S.

N79-28795*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
REMOTE MONITORING OF A THERMAL PLUME
Chin Y. Kuo (Virginia Polytech. Inst. and State Univ.) and Theodore A. Talay Jul. 1979 10 p refs Presented at Am. Soc. of Civil Engr., Hydraulics/Energy Div. Conf., San Francisco, 8-11 Aug. 1979
(NASA-TM-80125) Avail: NTIS HC A02/MF A01 CSCL 13B

A remote-sensing experiment conducted on May 17, 1977, over the Surry nuclear power station on the James River, Virginia is discussed. Isotherms of the thermal plume from the power station were derived from remotely sensed data and compared with in situ water temperature measurements provided by the Virginia Electric and Power Company, VEPCO. The results of this study were also qualitatively compared with those from other previous studies under comparable conditions of the power station's operation and the ambient flow. These studies included hydraulic model predictions carried out by Pritchard and Carpenter and a 5-year in situ monitoring program based on boat surveys. F.O.S.

N79-28796*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EFFECTS OF ROAD TRAFFIC BACKGROUND NOISE ON JUDGMENTS OF INDIVIDUAL AIRPLANE NOISES Ph.D. Thesis
Clemans A. Powell Jul. 1979 44 p refs
(NASA-TP-1433; L-12651) Avail: NTIS HC A03/MF A01 CSCL 13B

Two laboratory experiments were conducted to investigate the effects of road-traffic background noise on judgments of individual airplane flyover noises. In the first experiment, 27 subjects judged a set of 16 airplane flyover noises in the presence of traffic-noise sessions of 30-min duration consisting of the combinations of 3 traffic-noise types and 3 noise levels. In the second experiment, 24 subjects judged the same airplane flyover noises in the presence of traffic-noise sessions of 10-min duration consisting of the combinations of 2 traffic-noise types and 4 noise levels. In both experiments the airplane noises were judged less annoying in the presence of high traffic-noise levels than in the presence of low traffic-noise levels. Author

N79-28797# Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
AIRCRAFT NOISE CONTOURS EXPRESSED IN EPNdB IN CONGONHAS AIRPORT NEIGHBOURHOOD
Alex Lins Soares 18 Oct. 1976 78 p
(Rept-7610.901) Avail: NTIS HC A05/MF A01

The noise around Congonhas Airport, expressed in EPNdB for five different aircrafts along the flightpath in take-off and landing operations is presented. G.Y.

N79-28798# Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia). Div. of Atmospheric Physics.
THE CSIRO (AUSTRALIA) ATMOSPHERIC CARBON DIOXIDE MONITORING PROGRAM: THE FIRST SIX YEARS OF DATA
D. J. Beardsmore, G. I. Pearman, P. J. B. Fraser, and J. G. OToole 1978 73 p refs
(CSIRO-Technical-Paper-35) Avail: NTIS HC A04/MF A01

A description of the CSIRO carbon dioxide aircraft sampling network is given, together with the 6 years of data accumulated between its inception in 1972 and the end of 1977. Details are also provided of the sampling, analysis and calibration techniques employed to ensure that the sampling, analysis and calibration techniques employed to ensure that these data are compatible with those obtained by other carbon dioxide monitoring groups. Carbon dioxide concentrations are expressed in terms of the WMO 1974 CO2 Calibration Scale. Author

N79-28799*# Environmental Research and Technology, Inc., Concord, Mass.

EVALUATION OF THE SPATIAL AND TEMPORAL MEASUREMENT REQUIREMENTS OF REMOTE SENSORS FOR MONITORING REGIONAL AIR POLLUTION EPISODES

Hsiao-hua K. Burke, Clinton J. Bowley, and James C. Barnes Jul. 1979 65 p refs

(Contract NAS1-15531)

(NASA-CR-159092) Avail: NTIS HC A04/MF A01 CSCL 13B

The spatial and temporal measurement requirements of satellite sensors for monitoring regional air pollution episodes were evaluated. Use was made of two sets of data from the Sulfate Regional Experiment (SURE), which provided the first ground-based aerosol measurements from a regional-scale station network. The sulfate data were analyzed for two air pollution episode cases. The results of the analysis indicate that the key considerations required for episode mapping from satellite sensors are the following: (1) detection of sulfate levels exceeding 20 micron-g/cu m; (2) capability to view a broad area (of the order of 1500 km swath) because of regional extent of pollution episodes; (3) spatial resolution sufficient to detect variations in sulfate levels of greater than 10 micron-g/cu m over distances of the order of 50 to 75 km; (4) repeat coverage at least on a daily basis; and (5) satellite observations during the mid to late morning local time, when the sulfate levels have begun to increase after the early morning minimum levels, and convective-type cloud cover has not yet increased to the amount reached later in the afternoon. Analysis of the satellite imagery shows that convective clouds can obscure haze patterns. Additional parameters based on spectral analysis include wavelength and bandwidth requirements. F.O.S.

N79-28800# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

POLLUTANT DISPERSAL

1978 442 p refs Partly in ENGLISH and partly in FRENCH Lecture held at Rhode-Saint-Genese, Belgium, 8-12 May 1978 (VKI-LS-1978-7) Avail: NTIS HC A19/MF A01

Fluid dynamic aspects of pollutant dispersal in the atmosphere are described in a lecture series. Basic theories and recent advances in the treatment of turbulent dispersal are presented. Some particular topics of special interest, such as urban air pollutuon and plume dispersal, are discussed. For individual titles, see N79-28801 through N79-28809.

N79-28801# Cornell Univ., Ithaca, N. Y.

TURBULENT TRANSPORT OF PASSIVE CONTAMINANTS AND PARTICLES: FUNDAMENTALS AND ADVANCED METHODS OF NUMERICAL MODELING

J. L. Lumley *In* Von Karman Inst. for Fluid Dyn. Pollutant Dispersal 1978 57 p refs Sponsored in part by ONR and AFOSR (For primary document see N79-28800 19-45)

(Grant NSF ATM-77-22903)

Avail: NTIS HC A19/MF A01

A theory of material particles transport is developed. Homogeneous and inhomogeneous turbulence, concentration distribution as well as first and second order modeling are considered. Equations describing all the correlations for different variables and assumptions are presented. Author (ESA)

N79-28802# Pennsylvania State Univ., University Park. Dept. of Aerospace Engineering.

BUOYANCY EFFECTS IN ENTRAINING TURBULENT BOUNDARY LAYERS: A SECOND-ORDER CLOSURE STUDY

Otto Zeman and John L. Lumley *In* Von Karman Inst. for Fluid Dyn. Pollutant Dispersal 1978 8 p refs Sponsored in part by EPA, NSF, John Simon Guggenheim Mem. Found., and DGRST (For primary document see N79-28800 19-45)

Avail: NTIS HC A19/MF A01

A second-order modeling technique is used to investigate the structure of turbulent boundary layers under stable, neutral, and unstable conditions. Special attention is paid to the evening transition from a convective to a stable regime of an atmospheric entraining boundary layer capped by an inversion. The second-order closure scheme utilizes the turbulent transport model which incorporates buoyancy effects. The importance of the buoyancy contributions in the turbulent transport model for the process of entrainment and for the turbulence decay during the evening transition is discussed. Author (ESA)

N79-28803# Pennsylvania State Univ., University Park. Dept. of Aerospace Engineering.

TURBULENCE AND DIFFUSION MODELING IN BUOYANCY DRIVEN MIXED LAYERS

Otto Zeman and John L. Lumley *In* Von Karman Inst. for Fluid Dyn. Pollutant Dispersal 1978 9 p refs Repr. from 3d Symp. on Atmos. Turbulence Diffusion and Air Quality Am. Meteorol. Soc., 26-29 Oct. 1976 Sponsored in part by EPA, NSF, John Simon Guggenheim Mem. Found. and DGRST (For primary document see N79-28800 19-45)

Avail: NTIS HC A19/MF A01

A second order model for buoyancy-driven mixed layers was developed. Older second order models for atmospheric entraining layers did not included buoyancy effects. The numerical results presented show the feasibility of modeling entraining layers by second order techniques. The capability of the model to simulate the entrainment process realistically is largely attributed to the consideration of buoyancy effects. Author (ESA)

N79-28804# Systems Applications, Inc., San Rafael, Calif.

A REVIEW OF AIR POLLUTION MODELLING IN URBAN AREAS

Mei-Kao Liu *In* Von Karman Inst. for Fluid Dyn. Pollutant Dispersal 1978 62 p refs (For primary document see N79-28800 19-45)

Avail: NTIS HC A19/MF A01

A review of the current status of urban air quality modeling, particularly for gaseous photochemical pollutants, is made. Mathematical formulations, characterization of atmospheric processes, and the urban photochemical air quality model are discussed. Author (ESA)

N79-28805# Electricite de France, Chatou. Lab. National d'Hydraulique.

THE STRUCTURE OF BUOYANTT JETS VERTICALLY DISCHARGED INTO DIFFERENT KINDS OF ENVIRONMENTS

Pierre-Louis Viollet *In* Von Karman Inst. for Fluid Dyn. Pollutant Dispersal 1978 57 p refs In FRENCH; ENGLISH summary (For primary document see N79-28800 19-45)

Avail: NTIS HC A19/MF A01

The structure of turbulent buoyant jets vertically discharged into a calm or horizontally flowing medium is described. Data from previous studies as well as theoretical and epxerimental original results are use for describing the main physical phenomena involved, and to discuss the main existing models. Cases where the medium is homogeneous and cases where the medium is inhomogeneous in density or concentration are considered. The limits and application ranges of the jet models are defined. Author (ESA)

N79-28806# University of Eastern Illinois, Charleston. Dept. of Mathematics.

SOME COMPARISON BETWEEN THEORETICAL AND EXPERIMENTAL STUDIES OF COOLING TOWER PLUMES

S. K. Dey and G. K. Cooper *In* Von Karman Inst. for Fluid Dyn. Pollutant Dispersal 1978 88 p refs Sponsored in part by Argonne Natl. Lab. (For primary document see N79-28800 19-45)

Avail: NTIS HC A19/MF A01

Several models which predict behavior of cooling tower plumes are described. The performance of some of these models with regard to available experimental data is discussed. Considering the limitations of model formulation and data collection, the model to information data correlation is moderately good. Author (ESA)

N79-28807# Edinburgh Univ. (Scotland). Dept. of Meteorology.

ATMOSPHERE-SURFACE EXCHANGE OF POLLUTION: GASEOUS TRANSPORT TO ROUGH SURFACES

A. S. Thom *In* Von Karman Inst. for Fluid Dyn. Pollutant Dispersal 1978 15 p refs (For primary document see N79-28800 19-45)

Avail: NTIS HC A19/MF A01

A one dimensional treatment of the deposition rate of gaseous pollutants, under conditions of uniform vegetation, level ground, and adequate upwind fetch, is described. The difficulties with flux-gradient relationships over vegetation, as the thetford forest anomaly, and the related thermal enahancement model are discussed. Author (ESA)

N79-28808# Ecole Centrale de Lyon (France).

REMARKS ON PREDICTIVE METHODS IN ATMOSPHERIC TURBULENCE

J. Mathieu and J. N. Gence *In* Von Karman Inst. for Fluid Dyn. Pollutant Dispersal 1978 84 p refs Sponsored in part by DRET Prepared in cooperation with Elec. de France (For primary document see N79-28800 19-45)

Avail: NTIS HC A19/MF A01

A classification of predictive methods is made. Methods used on physical space, spectral methods, and other approaches are discussed. The model of the response of isotropic turbulence to shear and gravity is developed. A very simplified, but effective, model of industrial waste heat patterns of flow is described. Hard numerical problems are associated with the turbulent approach, leaving the simplified models shown in the examples as a means for reducing computing time. Author (ESA)

N79-28809# Electricite de France, Chatou. Lab. National d'Hydraulique.

STUDIES OF COOLING TOWER PLUMES BY COMPUTATION AND LOCAL MEASUREMENT [ETUDES DES PANACHES DE REFRIGERANTS ATMOSPHERIQUES PAR CALCULS ET MESURES IN SITU]

L. Caudron *In* Von Karman Inst. for Fluid Dyn. Pollutant Dispersal 1978 52 p refs In FRENCH (For primary document see N79-28800 19-45)

Avail: NTIS HC A19/MF A01

As part of the French program for the construction of power plants, atmospheric cooling towers witha 4,000 to 10,000 MW total capacity are planned. High power plume behavior was studied using measurements made on existing towers followed by theoretical analysis. Results show that as specific power increases, plumes several kilometers high easily form. Plumes are observed due to condensed humidity in neutral atmosphere or because of the restricted diffusion of the plume when limited by a stratified atmosphere, especially thermal inversions at 500 to 1,000 m. An increase in fog is considered not very probable although plume behavior closely follows meteorological conditions, vertical plumes corresponding to cumulus formation and stratified plumes to natural strati. Author (ESA)

N79-28810# Department of Energy, Washington, D. C.

ENVIRONMENTAL READINESS DOCUMENT: ENHANCED GAS RECOVERY. COMMERCIALIZATION PHASE 3 PLANNING

Sep. 1978 23 p

(DOE/ERD-0011) Avail: NTIS HC A02/MF A01

Based on the current state of knowledge and the assessed probability of adverse findings resulting from environmental research relating to the western (tight) gas sands and Devonian shale gas recovery, there appears to be several areas of environmental uncertainty facing the commercialization of the enhanced gas recovery (EGR) technology relating to these resources. The probability of contamination of and intrusions into groundwater systems is assessed to be low. The general technology to control such intrusions aboveground is considered capable of achieving environmentally acceptable operation of the EGR technology. The impacts of accidental aquifer contamination would not be severe. Probabilities stated are the synthesis of the collective judgments of Office of Environment scientists.DOE

N79-28811# Atomics International Div., Richland, Wash. Safety and Environmental Engineering Analysis Dept.

PROPOSED FORMAT AND CONTENT OF ENVIRONMENTAL REPORTS FOR DEEP GEOLOGIC TERMINAL REPOSITORIES FOR RADIOACTIVE MATERIAL

D. J. Carrell and G. L. Jones 13 Oct. 1978 148 p refs

(Contract EY-77-C-06-1030)

(RHO-BWI-CD-18) Avail: NTIS HC A07/MF A01

An annotated outline was developed which can serve as the basis for the environmental evaluation activites until replaced by an appropriate NRC regulatory guide. According to the outline, the major environmental effects that are expected to occur during the construction, operation, and terminal isolation phases of the radioactive material repository, should be summarized. These environmental effects should then be compared with the possible effect of continued use of interim storage facilities. Unless unforeseen environmental effects become apparent, the summary should be a positive statement indicating that the short-term environmental effects are outweighed by the long-term benefits of the repository. DOE

N79-28812# Department of Energy, Washington, D. C. Div. of Environmental Control Technology.

ENVIRONEMENTAL CONTROL TECHNOLOGY ACTIVITIES OF THE DEPARTMENT OF ENERGY IN FY 1978

Mar. 1979 108 p refs

(DOE/EV-0031) Avail: NTIS HC A06/MF A01

This second in a series of annual reports on environmental control technology activities within DOE serves as a basis for evaluating program progress. The total DOE-FY-78 funding allocation related to environments control activities was $294 million, which corresponds to 3.3% of the total FY-78 budget. Funding allocations for environmental control activities in the budget show fossil and nuclear energy technologies accounting for 90% of the total (26 and 64%, respectively). The majority of the fossil-energy-related activities were related to the coal program. Waste management activities demanded the majority of the nuclear energy funds. Conservation and geothermal made up 4 and 3%, respectively, of the total. The remaining portion of the total consisted of solar (2%), basic energy sciences (1%), and magnetic fusion energy (less than 1%). Author (DOE)

N79-28813# Oak Ridge National Lab., Tenn. Environmental Sciences Div.

AIR QUALITY AND POINT SOURCE EMISSIONS DATA FOR THE SOUTHERN UNITED STATES

R. H. Strand Feb. 1979 40 p refs

(Contract W-7405-eng-26)

(ORNL/TM-6742; Publ-1290) Avail: NTIS HC A03/MF A01

The type and quantity of data available in the EPA air quality and point source emissions files were summarized for 16 southeastern states. THe data give an objective spatial and temporal summary of air quality and emissions for SO2, NO2, and total suspended particulates. These data are useful for comparing air quality trends between geographic areas and relating these trends to changing source strengths and patterns and for quantifying the current burden of pollutants in an area to predict consequences of man's activities. Such information will also be useful for detection of regional patterns of coincidence of population densities, physiographic features, or vegetation types with high burdens of atmospheric pollutants. DOE

N79-28814# Brookhaven National Lab., Upton, N. Y.

HIERARCHIAL DECOMPOSITION APPROACH TO ENVIRONMENTAL POLICY ANALYSIS

William Marcuse May 1978 43 p refs Presented at Workshop on Econ. Meas. of Energy Related Environ. Damages, Golden, Colo., 21-22 Jun. 1978

(Contract EY-76-C-02-0016)

(BNL-24444; Conf-7806121-1) Avail: NTIS HC A03/MF A01

A methodology for environmental analysis is presented that starts with the regional and national models, in this case the multi-regional energy system optimization model and the Brookhaven energy system optimization model, used in a mode for solar technology assessment. Disaggregation to sectors was made through the Brookhaven Univ. of Illinois input-output model, and the national energy supply, energy demand, and nonenergy sectoral outputs were calibrated (used as control totals) for the regional model. The regional model is then used for energy siting through the county level electric facility siting model. The emissions, then localized at the county level, were fed into the emissions transport model that determines the air quality. These can then be used with a damage function to determine the health impact of energy generation emissions, and with appropriate coefficients, to determine the health impacts of extraction transport, and processing. DOE

N79-28815# Environmental Monitoring and Support Lab., Research Triangle Park, N. C.
OZONE CALIBRATION AND AUDIT BY GAS PHASE TITRATION IN EXCESS OZONE: BENDIX (TRADENAME) TRANSPORTABLE FIELD CALIBRATION SYSTEM, MODELS 8861D AND 8861DA
Thomas A. Lumpkin and Barry E. Martin Feb. 1979 49 p refs
(PB-293341/4; EPA-600/4-79-015) Avail: NTIS HC A03/MF A01 CSCL 14B

Detailed procedures for the dynamic calibration and audit of chemiluminescence ozone analyzers are presented. The calibrations and audits are performed by means of a gas phase titration technique using the rapid gas phase reaction between nitric oxide and ozone with excess ozone present. One of the advantages of the procedures is that chemiluminescence ozone analyzers can be calibrated or audited in the field without the bulky equipment required for the neutral buffered potassium iodide calibration procedure. A second advantage is that more precise results can be obtained. GRA

N79-28816# Environmental Protection Agency, Ann Arbor, Mich. Standards Development and Support Branch.
EXHAUST EMISSIONS AND FUEL CONSUMPTION OF A HEAVY DUTY DIESEL VEHICLE OVER VARIOUS DRIVING CYCLES - GMC ASTRO 95, 8V-71NA
Aug. 1978 51 p
(PB-293766/2; HDV-78-10) Avail: NTIS HC A04/MF A01 CSCL 21D

These driving cycles were developed from actual in-use operational data collected in New York and Los Angeles. In each location, data collected for freeway and non-freeway operation was segregated. A data matrix (relating speed, acceleration and frequency of occurence) was prepared for each city and type of operation. The test program was designed to evaluate the concept of chassis testing for large diesel vehicle. Along with this goal, it was desired to determine emission factors and fuel consumption by category of operation and to determine the cariation with vehicle load. Also, to verify the cycle generation technique, the sensitivity of emissions and fuel consumption was to be established. GRA

N79-28817# Martin Marietta Corp., Baltimore, Md. Environmental Center.
EVALUATION OF THE GAUSSIAN PLUME MODEL UNDER STABLE CONDITIONS AT THREE MARYLAND POWER PLANTS Final Report
Roger P. Bower Mar. 1979 60 p refs Sponsored by Dept. of Natural Resources
(PB-293726/6; PPSP-MP-25) Avail: NTIS HC A04/MF A01 CSCL 04A

Model predictions were compared to field measurements of SO2 groundlevel concentrations during stable stable atmospheric conditions. It was found that, in general, all prediction techniques underestimated the cross wind dispersion. Poor agreement was also obtained between measured and predicted SO2 concentrations. GRA

N79-28818# GCA Corp., Bedford, Mass. Technology Div.
FABRIC FILTER MODEL FORMAT CHANGE. VOLUME 2: USER'S GUIDE Final Report, Nov. 1977 - Dec. 1978
Richard Dennis and Hans A. Klemm Feb. 1979 31 p refs (Contract EPA-68-02-2607)
(PB-294042/7; GCA-TR-78-51-G(2); EPA-600/7-70-043B) Avail: NTIS HC A03/MF A01 CSCL 13K

An improved mathematical model for use by control personnel to determine the adequacy of existing or proposed filter systems designed to minimize coal fly ash emissions is described. GRA

N79-28819# Bendix Corp., Baltimore, Md. Environmental and Process Instruments Div.
DEVELOPMENT OF AN IMPROVED TAMPER-PROOF FILTE.. CASSETTE Final Open File Report
7 Aug. 1978 19 p
(Contract DI-BM-H0-252094)
(PB-294186/2; BM-OFR-30-79) Avail: NTIS HC A02/MF A01 CSCL 13K

The design effort, fabrication and testing of five prototype units, and the design and production of 1,000 filter cassettes with sampling heads is presented. This new improved filter cassette was tested and approved as meeting the specified requirments. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N79-28820 George Washington Univ., Washington, D. C.
STRONG INTERACTIONS IN GRAVITATION THEORY Ph.D. Thesis
John Kenneth Sellers 1979 130 p
Avail: Univ. Microfilms Order No. 7915610

A geometrical approach is used wherein the gauge field enters through the affinity which helps to define covariant differentiation in the combined space of Dirac spin and internal symmetries. Gravity enters, as in the theory of general relativity, by covariant extension to a Riemann space. A calculus of four component spinors using a notation similar to that introduced by van der Waerden for two component spinors is presented. The concept of a hermitian metric for the spin space is placed on a firm footing by providing a definition which defines it uniquely, within a numerical factor. A Lorentz invariant generalization of the spin metric is demonstrated. The mass of the Dirac field is then shown to be functionally related to parameters in the general spin metric. Dissert. Abstr.

N79-28821 Purdue Univ., Lafayette, Ind.
THE SIESMIC RESPONSE OF A COLUMN-SUPPORTED COOLING TOWER Ph.D. Thesis
Carl Stanley Gran 1978 142 p
Avail: Univ. Microfilms Order No. 7914901

Hyperboloidal reinforced-concrete shells are modeled using orthotropic quadrilateral flat plate finite elements. The supporting columns and top ring beam are modeled by beam finite elements. Natural frequencies and corresponding mode shapes are found for several different tower configurations. Results for fixed-base shells are in close agreement with those determined using alternate methods of analysis. A high-order, doubly-curved membrane shell finite element is developed for application to the study of column-supported cooling towers. Element geometry, defined by lines of principal curvature, is restricted to shells of revolution but allows a third-order representation of the meridian. Element displacement assumptions are bicubic for the in-plane displacements and bilinear for the transverse displacement. The element stiffness matrix is partitioned by writing the mixed partial derivatives in terms of the rest of the degrees of freedom, thus forming an element with 28 degrees of freedom. Three rigid body modes are implicitly included in the formulation. Convergence characteristics are excellent as demonstrated by several examples, both static and dynamic. Dissert. Abstr.

N79-28822 University of Southern Illinois at Carbondale.
THE ROLE OF CLIMATE-ASSOCIATED FORCE AND RESISTANCE FUNCTIONS IN REGIONAL EROSION RATE VARIATIONS Ph.D. Thesis
Redmond Robert Clark 1978 128 p
Avail: Univ. Microfilms Order No. 7916071

A sample of basin erosion rates was used to test the force/resistance equations. The basin sizes were controlled to minimize storage variations, and record lengths were maximized to insure the representative nature of the measured loss rates. Comparison of erosion rates with traditional models of erosion (models expressing variations in force but not resistance) demonstrated no significant relationships, but use of the surplus/biomass index generated an r value of .76, significant at the .01 confidence level. The failure of traditional indices and the success of the surplus/biomass ratio may offer insights into the effects of land use and climatic change on regional erosion rates. Dissert. Abstr.

N79-28823*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN EVOLUTIONARY APPROACH TO THE GROUP ANALYSIS OF GLOBAL GEOPHYSICAL DATA
James I. Vette Feb. 1979 53 p refs
(NASA-TM-80344; NSSDC/WDC-A-R/S-79-02) Avail: NTIS HC A04/MF A01 CSCL 08G

The coordinated data analysis that developed within the International Magnetospheric Study is presented. A tracing of its development along with various activities taking place within this framework are reported. M.M.M.

N79-28824*# Ohio State Univ. Research Foundation, Columbus. Dept. of Geodetic Science.
GLOBAL ANOMALY AND UNDULATION RECOVERY USING GEOS-3 ALTIMETER DATA Final Report
Richard H. Rapp May 1979 54 p refs
(Grant NsG-5275)
(NASA-CR-158805; Rept-285) Avail: NTIS HC A04/MF A01 CSCL 08E

The data were adjusted to remove orbit error and altimeter bias in a primary adjustment and four regional adjustments. The root mean square crossover discrepancy was about + or - 55 cm after the adjustment. The adjusted altimeter data, now considered to give geoid undulations, was used to predict values at 1 deg intersections from which an oceanic geoid map, with predicted accuracies, was prepared at a two meter contour interval. This geoid was compared to the Gemini 9 geoid over very long profiles to examine the long wavelength error in the altimeter geoid. At a wavelength of 13,010 km the root mean squares difference was 57 cm. The altimeter geoid was also compared to altimeter geoids fixed by precise orbits. A root mean square difference was found of about 1 m with a systematic difference that implied the equatorial radius of the earth was 6,378,137 meters. The adjusted altimeter data was also used to determine a total of 29,479 1 deg x 1 deg anomalies (and undulations). R.E.S.

N79-28825*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
BIBLIOGRAPHY OF GEOLOGIC STUDIES USING IMAGING RADAR
M. Leonard Bryan 1 Jul. 1979 125 p Presented at NASA/JPL Radar Geology Workshop, Snowmass, Colorado, 16-20 Jul. 1979 Prepared for DOE
(Contract NAS7-100)
(NASA-CR-158820; JPL-Pub-79-53) Avail: NTIS HC A06/MF A01 CSCL 08G

Articles concerning imaging studies on the geomorphology, mineralogy, and topology of various landforms are reported. One hundred and ninety citations are listed and an index by National Technical Information service citation number is included. Several illustrations of L-band radar imagery are presented. M.M.M.

N79-28826*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MAGNETOPAUSE SURFACE FLUCTUATIONS OBSERVED BY VOYAGER 1
R. P. Lepping and L. F. Burlaga Jun. 1979 39 p refs Submitted for publication
(NASA-TM-80300) Avail: NTIS HC A03/MF A01 CSCL 04A

Moving out of the dawnside of the earth's magnetosphere, Voyager 1 crossed the magnetopause apparently seven times, despite the high spacecraft speed of 11 km/sec. Normals to the magnetopause and their associated error cones were estimated for each of the crossings using a minimum variance analysis of the internal magnetic field. The oscillating nature of the ecliptic plane component of these normals indicates that most of the multiple crossings were due to a wave-like surface disturbance moving tailward along the magnetopause. The wave, which was aperiodic, was modeled as a sequence of sine waves. The amplitude, wavelength, and speed were determined for two pairs of intervals from the measured slopes, occurrence times, and relative positions of six magnetopause crossings. The magnetopause thickness was estimated to lie in the range 300 to 700 km with higher values possible. The estimated amplitude of these waves was obviously small compared to their wavelengths. A.R.H.

N79-28827*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
THE PHOTOLYSIS OF CHLORINE IN THE PRESENCE OF OZONE, NITRIC ACID AND NITROGEN DIOXIDE
Wanee Wongdontri Stuper Aug. 1979 182 p refs
(Grant NGL-39-009-003)
(NASA-CR-158853; PSU-IRL-SCI-462; SR-462) Avail: NTIS HC A09/MF A01 CSCL 04A

The following three systems were investigated: the Cl2-O3 system, the Cl2-O2-NO system and the Cl2-NO2-M system. In the first system, the reaction between ClO and O3, the reaction between OClO and O3, and the mechanism of the Cl2-O3 system were studied. In the second system, the reaction between ClOO and NO was investigated. In the last system, the reaction between Cl and NO2 was investigated as well as the kinetics of the chemiluminescence of the Cl-NO2-O3 reaction. In the first system, Cl2 was photolyzed at 366 nm in the presence of O3 within the temperature range 254-297 K. O3 was removed with quantum yields of 5.8 + or - 0.5, 4.0 + or - 0.3, 2.9 + or - 0.3 and 1.9 + or - 0.2 at 297, 283, 273, and 252 K respectively, invariant to changes in the initial O3 or Cl2 concentration, the extent of conversion or the absorbed intensity, I sub a. The addition of nitrogen had no effect on -phi(O3). The Cl2 removal quantum yields were 0.11 + or - 0.02 at 297 K for Cl2 conversions of about 30%, much higher than expected from mass balance considerations based on the initial quantum yield of 0.089 + or - 0.013 for OClO formation at 297 K. The final chlorine-containing product was Cl2O7. It was produced at least in part through the formation of OClO as an intermediate which was also observed with an initial quantum yield of phi sub i(OClO) = 2500 exp(-(3025 + or - 625)/T) independent of (O3) or I sub a. F.O.S.

N79-28828# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
A SEMI-EXPERIMENTAL ESTIMATION OF THE LOCATION OF THE F-REGION MAXIMUM INTENSITY EMISSION LAYER
J. H. A. Sobral and C. J. Zamlutti Dec. 1978 12 p refs
(INPE-1410-PE/189) Avail: NTIS HC A02/MF A01

About 232 electron density profiles were used to construct 6300 angstrom emission profiles which, in turn, provided the height of the maximum intensity emission layer. Calculation of the emission profile utilized also the observed red line intensity in order to determine the neutral profile which would yield the observed airglow intensity as observed from the ground. The results show that the maximum intensity emission layer is located, on an average, at about 56 km below the electron density peak. Other dynamical features of the maximum intensity emission layer are also discussed. R.E.S.

N79-28829*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE INFLUENCE OF IONIZATION EVENTS ON ATMOSPHERIC OZONE
Arthur C. Aikin Jun. 1979 22 p refs Submitted for publication
(NASA-TM-80318) Avail: NTIS HC A02/MF A01 CSCL 04A

Atmospheric ionization events can modify the concentration of neutral species in the stratosphere and mesosphere. In particular, ozone is destroyed because of the production of significant quantities of odd nitrogen and hydrogen compounds which react photochemically to destroy ozone. Direct evidence of ozone depletion comes from data taken during and following two solar flares generating large fluxes of 10-100 Mev protons, which bombarded the polar stratosphere and mesosphere. Observations of ozone taken during X-ray emission by solar flares and energetic electron precipitation during aurorae indicates ozone destruction above 50 km by ionization produced odd hydrogen. Lightning is apparently a large contributor to the tropospheric odd nitrogen budget. Ion propulsion induced dumping of the inner proton radiation belt represents a human activity which may influence stratospheric NOx. Author

N79-28830*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
POSTSEISMIC VISCOELASTIC SURFACE DEFORMATION AND STRESS. PART 1: THEORETICAL CONSIDERATIONS, DISPLACEMENT AND STRAIN CALCULATIONS
Steven C. Cohen May 1979 38 p refs Submitted for publication
(NASA-TM-80292) Avail: NTIS HC A03/MF A01 CSCL 08K

A model of viscoelastic deformations associated with earthquakes is presented. A strike-slip fault is represented by a rectangular dislocation in a viscoelastic layer (lithosphere) lying over a viscoelastic half-space (asthenosphere). Deformations occur on three time scales. The initial response is governed by the instantaneous elastic properties of the earth. A slower response is associated with viscoelastic relaxation of the lithosphere and a yet slower response is due to viscoelastic relaxation of the asthenosphere. The major conceptual contribution is the inclusion of lithospheric viscoelastic properties into a dislocation model of earthquake related deformations and stresses. Numerical calculations using typical fault parameters reveal that the postseismic displacements and strains are small compared to the coseismic ones near the fault, but become significant further away. Moreover, the directional sense of the deformations attributable to the elastic response, the lithospheric viscoelastic softening, and the asthenospheric viscoelastic flow may differ and depend on location and model details. The results and theoretical arguments suggest that the stress changes accompanying lithospheric relaxation may also be in a different sense than and be larger than the strain changes. F.O.S.

N79-28831# SRI International Corp., Menlo Park, Calif.
SIMULTANEOUS MEASUREMENTS OF THE AURORAL IONOSPHERE BY THE CHATANIKA RADAR AND THE S3-2 SATELLITE Final Report, 1 Mar. - 30 Sep. 1978
Richard R. Vondrak Jan. 1979 40 p refs
(Contract F19628-78-C-0081; AF Proj. 2311)
(AD-A067939; AFGL-TR-79-0048) Avail: NTIS HC A03/MF A01 CSCL 04/1

Ionospheric measurements made with the Chatanika radar during overflights of the S3-2 satellite have been analyzed to obtain the variation of ionization, conductivity, electric field, electric current, and the precipitating electron energy distribution. This report presents the analysis of four data sets consisting of simultaneous radar and satellite measurements. The first three sets, from January and February of 1976, were made when the equatorward edge of the evening diffuse aurora was near the Chatanika radar. The fourth data set, from February 1977, was obtained during a morning active aurora. Author (GRA)

N79-28832*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
INTENSE ELECTROSTATIC WAVES NEAR THE UPPER HYBRID RESONANCE FREQUENCY
W. S. Kurth, J. D. Craven, L. A. Frank, and D. A. Gurnett Oct. 1978 77 p refs
(Contracts NAS1-13129; NAS5-11074; Grant NGL-16-001-043; Contract N00014-76-C-0016)
(NASA-CR-158841; AD-A067612; U-OF-IOWA-78-36) Avail: NTIS HC A05/MF A01 CSCL 04/1

Plasma wave measurements using instruments on the IMP 6 and Hawkeye 1 satellites are utilized in a study of very intense electrostatic waves near the upper hybrid resonance frequency in the region just outside the plasmapause. These intense plasma wave events have electric field strengths of about 1 to 20 mV/m and are among the most intense waves seen in the earth's magnetosphere. Detailed studies of more than 140 of these intense electrostatic disturbances reveal that the events occur at all local times and at magnetic latitudes varying from the equator to as high as 50 deg. The polarization of these waves is such that the wave electric field vector is oriented perpendicular to the geomagnetic field. In most cases the center frequency of the intense waves appears to correspond to an (n + 1/2)f(-) sub g harmonic near the upper hybrid resonance frequency. A possible mechanism for producing intense waves near the upper hybrid resonance frequency is suggested which draws upon current theories applied to the generation of (n + 1/2)f(-) sub g bands. Evidence is given which suggests that the intense electrostatic waves may be a source of nonthermal continuum radiation.GRA

N79-28833# McDonnell-Douglas Corp., Huntington Beach, Calif.
MAGNETOSPHERIC MAGNETIC FIELD MODELING Final Report
W. P. Olson and K. A. Pfitzer Feb. 1979 57 p refs
(Contract F44620-75-C-0033; AF Proj. 2311)
(AD-A067597; AFOSR-79-0432TR) Avail: NTIS HC A04/MF A01 CSCL 04/1

This report describes work that has been performed within the last year on the modeling of the disturbed magnetospheric magnetic field. The reasons for developing quantitative magnetospheric models are twofold: first, there are many model users who have practical needs. Their requirements are to specify and to predict such things as: radiation dose in the earth orbital environment, fluctuations in ionospheric electron density, variations in the earth's upper atmosphere density, and the impact of magnetic storms on loading changes in electrical power grids. The second set of model users have technical and scientific needs. They use the magnetic field models in studies of other magnetospheric, ionospheric, and upper atmospheric phenomena, or to understand the interactions of magnetospheric magnetic and electric fields with particle populations. This report should be the last of a series quantitatively describing the magnetospheric magnetic field. Some of the history of the magnetic field work that leads to the efforts pursued this last year is described.
Author (GRA)

N79-28834# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
EFFECT OF TEMPERATURE ON THE STRENGTH OF SNOW-ICE
F. D. Haynes Dec. 1978 26 p refs
(AD-A067583; CRREL-78-27) Avail: NTIS HC A03/MF A01 CSCL 08/12

Uniaxial compression and tension tests were conducted on polycrystalline snow-ice to determine the effect of temperature on its strength. Test temperatures ranged from -0.1 C to -54 C. Two machine speeds, 0.847 mm/s and 84.7 mm/s were used for the constant displacement rate tests. The compressive strength at -54 C was about one order of magnitude higher than at -0.1 C. The tensile strength at -18 C was about 20% higher than at -0.1 C. The initial tangent and 50% strength moduli are given for the compression tests, while the secant modulus to failure is given for the tension tests. The mode of fracture is discussed and the test results are compared with data from other investigations. GRA

N79-28835# Naval Research Lab., Washington, D. C. Optical Sciences Div.
HIGH-RESOLUTION ATMOSPHERIC-TRANSMISSION SPECTRA FROM 5 TO 3 MICROMETERS Interim Report
Kenneth M. Haught 9 Mar. 1979 17 p refs
(NRL Proj. R05-31; NRL Proj. S01-82A)
(AD-A068468; AD-E000291; NRL-8297) Avail: NTIS HC A02/MF A01 CSCL 04/1

This report describes the field-measurement and data-reduction procedures used to obtain longpath, absolute-transmission spectra in the 5 to 3 micrometers atmosheric window. These measurements were carried out under a wide range of meteorological conditions. Key results of these measurements have been assembled into a data base of high-resolution atmospheric-transmission spectra which is now available on digital magnetic tape. Author (GRA)

N79-28836# R and D Associates, Marina Del Rey, Calif.
EFFECT OF LATERAL GRADIENTS ON ELF PROPAGATION IN THE EARTH-IONOSPHERE WAVEGUIDE Topical Report, 16 Oct. 1977 - 31 Sep. 1978
Carl Greifinger and Phyllis Greifinger 30 Sep. 1978 38 p refs
(Contract DNA001-78-C-0009)
(AD-A068124; AD-E300468; RDT-TR-107005-003; DNA-4696T) Avail: NTIS HC A03/MF A01 CSCL 20/14

The effect of steep lateral gradients on ELF propagation in the earth-ionosphere waveguide is investigated by full-wave calculations based on two different models of the waveguide. In

both models, the ionosphere is replaced by a mathematically equivalent upper wall. In one model, the height of the waveguide is taken to vary in the lateral direction, but the surface impedance of the upper wall is assumed constant. In the other model, the surface impedance is taken to vary laterally, but the height is assumed constant. Magnetic field strengths are calculated along various great circle paths through the transmitter and compared with values obtained from the great circle WKB approximation for the same paths. The results for the two models are not very different from each other, and both are in agreement with the WKB results to within 1 or 2 db at distances of several thousand kilometers. GRA

N79-28837# Scripps Institution of Oceanography, La Jolla, Calif. Visability Lab.

AIRBORNE MEASUREMENTS OF ATMOSPHERIC VOLUME SCATTERING COEFFICIENTS IN NORTHERN EUROPE, SUMMER, 1977 Interim Report

Seibert Q. Duntley, Richard W. Johnson, and Jacqueline I. Gordon Jun. 1978 172 p refs

(Contract F19628-76-C-0004; AF Proj. 7621)

(AD-A068611; SIO-Ref-78-28; AFGL-TR-78-0168; SR-9) Avail: NTIS HC A08/MF A01 CSCL 20/6

This report presents daytime atmospheric optical data collected chiefly with airborne instruments during a field expedition to northern Europe in the Summer of 1977. Results from 12 flights are presented. The data include the natural irradiance upon horizontal plane surfaces, total volume scattering coefficients, and derived values of atmospheric beam transmittance and equivalent attenuation length. Data for daytime conditions ranging from relatively clear and cloud free to completely overcast are presented. Data were measured in four spectral regions, as follows: Three narrow band optical filters with mean wavelengths of 478, 664, and 765 nanometer; and one broad band sensitvity representing a pseudo-photopic response with a mean wavelength of 557 nanometers. Selected meteorological properties, measured concurrently with the radiometric data are also included.

Author (GRA)

N79-28838# IRT Corp., San Diego, Calif.

MEASUREMENTS OF SELECTED CHARGE TRANSFER PROCESSES AT LOW ENERGIES Final Report, Nov. 1977 - Nov. 1978

J. A. Rutherford, R. H. Neynaber, and D. A. Vroom Nov. 1978 29 p refs

(Contract DNA001-77-C-0202)

(AD-A069046; AD-E300516; DNA-4695F) Avail: NTIS HC A03/MF A01 CSCL 04/1

Measurement of the charge transfer cross section for the process N(+) + O yields N + O (+) was completed during the contract year. The experiment was conducted using a crossed beam apparatus. The O atoms were formed in a microwave or rf discharge using pure O2 with traces of H2O present. Varying the amount of H2O present allowed the dissocation fraction in the O2 to the varied. This variation was needed to allow determination of the effects of other competing processes. The cross section for the above reaction was determined in the energy range from 0.5 eV to 12 eV in the center-of-mass system. The signals obtained indicated that this process does not vary rapidly with energy. The cross section was determined to be 1.2 x 10 to the -17th power sq cm at the lowest energies studied and increases to approximately 2.5 x 10 to the -17th power sq cm at 12 eV in the center-of-mass. Cross sections for the reactions Al(+) + O2 yields AlO(+) + O and Al + O2(+) and Al(+) + N2 yields Al(+) + N and Al (+) + N2(+) were measured during the contract period. The values determined for these processes were essentially the same as those measured previously. In addition, the upper limits determined at energies where these processes have very small probabilities were pushed to lower values. The measurements were undertaken to resolve a conflict between our data and cross section values postulated to explain results obtained in another experiment. GRA

N79-28839# Aerospace Corp., El Segundo, Calif. Satellite Systems Div.

IONOSPHERIC MEASUREMENTS FROM NAVSTAR SATELLITES Final Report

P. S. Jorgensen Dec. 1978 47 p

(Contract F04701-78-C-0079)

(AD-A068809; TR-0079(4475-01)-2; SAMSO-TR-79-29) Avail: NTIS HC A03/MF A01 CSCL 04/1

For several months, three Navstar satellites have been extensively tracked by monitor stations located in California, Alaska, Hawaii, and Guam. As part of this tracking process, data was acquired which is a measure of the ionospheric delay encountered by the navigation signal from the satellites. This report describes the measurement techniques used at the monitor stations, the data obtained from these measurements, and the methods used to compute ionospheric delay. Typical plots of this delay for the various combinations of monitor stations and satellites are presented. GRA

N79-28840# California Univ., Livermore. Lawrence Livermore Lab.

SIGNATURES OF THE VARIOUS REGIONS OF THE OUTER MAGNETOSPHERE IN THE PITCH ANGLE DISTRIBUTIONS OF ENERGETIC PARTICLES

Harry I. West, Jr. 11 Dec. 1978 44 p refs Presented at Conf. on Quantitative Modeling of Magnetospheric Processes, La Jolla, Calif., 19 Sep. 1978

(Contract W-7405-eng-48)

(UCRL-81152-Rev-1; Conf-780938-4) Avail: NTIS HC A03/MF A01

An account is given of the observations of the pitch angle distributions of energetic particles in the near equatorial regions of the earth's magnetosphere. The emphasis is on relating the observed distributions to the field configuration responsible for the observed effects. The observed effects relate to drift-shell splitting, to the breakdown of adiabatic guiding center motion in regions of sharp field curvature relative to partial gyro radii, to wave particle interactions, and to moving field configurations. DOE

N79-28841# California Univ., Berkeley. Lawrence Berkeley Lab.

ROCKING AND OVERTURNING RESPONSE OF RIGID BODIES TO EARTHQUAKE MOTIONS: A REPORT OF AN ANALYTICAL AND EXPERIMENTAL STUDY ON THE ROCKING AND OVERTURNING RESPONSE OF RIGID BLOCKS TO SIMULTANEOUS HORIZONTAL AND VERTICAL ACCELERATIONS

M. Aslam, W. G. Godden, and D. T. Scalise Nov. 1978 91 p refs

(Contract W-7405-eng-48)

(LBL-7539) Avail: NTIS HC A05/MF A01

A fundamental study of the rocking and overturning response of massive concrete blocks (with relatively high aspect ratio) to simultaneous horizontal and vertical earthquake ground motions is presented. This problem occurs when large concrete blocks are used as radiation shields in particle accelerators or similar nuclear installations. An insight into the response of the rigid bodies (such as are approximated by some electrical machinery and mechanical equipment) which are not anchored to the ground is presented. The mathematical model used was based on the assumption of a constant coefficient of restitution. A computer program was written to predict the rocking and overturning behavior of rigid rectangular blocks under simultaneously applied horizontal and vertical ground accelerations. Using the computer program, the response of rigid blocks of various aspect ratios and sizes was studied under the accelerograms of various strong motion earthquakes. DOE

N79-28842# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).

TWELVE BIT DATA ACQUISITION SYSTEM FOR THE GRAVITATIONAL WAVE EXPERIMENT

G. Martinelli and G. Vannaroni Nov. 1978 48 p refs

(LPS-78-15) Avail: NTIS HC A03/MF A01

The data acquisition system designed to record measurements obtained from a gravitational wave resonant antenna is described. A signal is obtained by a ceramic transducer coupled to the antenna. Measurements on resonant frequencies are taken on six analog input lines corresponding to three measurement channels, with a resolution of 12 bits and with sampling times selectable from 1 ms to 9 sec. The data are recorded on a compatible IBM magnetic tape unit. The apparatus also performs

periodic acquisition of auxiliary data pertinent to the status of the experiment and its environment as well as a periodic calibration sequence for the analog to digital converter. Author (ESA)

N79-28843# SRI International Corp., Menlo Park, Calif.
REACTIONS OF OXY RADICALS IN THE ATMOSPHERE Final Report, Jun. 1975 - Jun. 1978
D. G. Hendry, R. A. Kenely, J. E. Davenport, and B. Y. Lan Mar. 1979 81 p refs
(Grant EPA-603864)
(PB-294046/8; EPA-600/3-79-020) Avail: NTIS HC A05/MF A01 CSCL 04A

Reactions of importance in atmospheric chemistry were studied. The decomposition of peroxyacetyl nitrate was studied over the temperature range 25 - 39 C. The rate constant was determined to be log k = 16.29 - 26,910/4.576 T. The reactions of acetylperoxy radicals with NO and NO2 were investigated. The products of the reaction of OH with various aromatic compounds were also determined. The investgation showed that the reaction of OH with simple aromatic hydrocarbons proceeds by two major pathways, abstraction of a hydrogen atom in the benzylic position or addition of OH to the aromatic ring. Results of a study of elucidate the products and mechanism of the reaction of OH with benzaldehyde are also presented. GRA

N79-28844# Systems Applications, Inc., San Rafael, Calif.
FURTHER STUDIES OF REGIONAL DIFFUSION MODELING IN THE NORTHERN GREAT PLAINS Final Report
Mei-Kao Liu and Michael Wojcik Mar. 1979 125 p refs
(Contract EPA-68-01-3591)
(PB-295386/7; EF78-88R; EF79-40; EPA-908/1-78-005) Avail: NTIS HC A06/MF A01 CSCL 04A

Methods for characterizing wind field and mixed layer diffusivity in mesoscale air quality modeling were investigaed. After a review of pertinent theoretical and observational studies, the geostrophic wind and a scheme for horizontal eddy diffusivites were selected. A bicubic spline fit was used to interpolate the geopotential height data needed for implementation of this scheme. This method was used to compute the wind fields and horizontal diffusivities. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N79-28845 Yale Univ., New Haven, Conn.
THE ROLE OF MEAN MERIDIONAL MOTION IN CLIMATE MODELING Ph.D. Thesis
Karl Edward Taylor 1978 260 p
Avail: Univ. Microfilms Order No. 7916525

A numerical model of the atmosphere was developed to study the axially-symmetric component of climate. Using the zonally averaged, primitive set of hydrodynamic equations, the zonally averaged temperature and wind at two levels in the atmosphere (nominally, 250 and 750 mb) were calculated. The surface temperature and surface pressure are also calculated. As in the natural atmosphere, the model atmosphere is forced by an externally prescribed solar insolation. Other forms of diabatic heating, friction, and eddy stresses are parameterized in terms of zonally averaged variables. Dissert. Abstr.

N79-28846 Purdue Univ., Lafayette, Ind.
NUMERICAL SIMULATION OF MESOSCALE CONVECTION Ph.D. Thesis
Pi-Jaw Sheu 1978 91 p
Avail: Univ. Microfilms Order No. 7914970

A two dimensional nonlinear model of cellular convection was developed and solved numerically, which shows excellent agreement with existing laboratory and theoretical findings. In this model three factors (anisotropy, moisture and large-scale sinking motion) were shown, independently, to increase the scale of organized convection from small-scale cumulus elements to mesoscale cellular convection. The nonlinear model shows that the preferred aspect ratio more closely simulates a square root relationship to the degree of anisotropy, than that predicted by linear theory. Dissert. Abstr.

N79-28847*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SURFACE TO 90 km WINDS FOR KENNEDY SPACE CENTER, FLORIDA, AND VANDENBERG AFB, CALIFORNIA
D. L. Johnson and S. C. Brown Jul. 1979 63 p refs
(NASA-TM-78233) Avail: NTIS HC A04/MF A01 CSCL 04B

Bivariate normal wind statistics for a 90 degree flight azimuth, from 0 through 90 km altitude, for Kennedy Space Center, Florida, and Vandenberg AFB, California are presented. Wind probability distributions and statistics for any rotation of axes can be computed from the five given parameters. G.Y.

N79-28848# National Aviation Facilities Experimental Center, Atlantic City, N. J.
THE ANALYSIS OF NATIONAL TRANSPORTATION SAFETY BOARD SMALL SINGLE-ENGINE FIXED-WING AIRCRAFT ACCIDENT/INCIDENT REPORTS FOR THE POTENTIAL PRESENCE OF LOW-LEVEL WIND SHEAR Final Report
Jack J. Shrager May 1979 78 p refs
(AD-A069438; FAA-RD-79-3; FAA-NA-78-39) Avail: NTIS HC A05/MF A01 CSCL 04/2

The National Transportation Safety Board aircraft accident/incident data base covering the years 1964 through 1975 was screened to select those accidents involving single-engine aircraft of less than 12,500 pounds gross weight in which the potential of low-level wind shear as a factor could not be discounted. The software filtering resulted in identifying 2,469 small single-engine aircraft accident briefs which met the criteria for the possible presence of wind shear. A review of these briefs for the years 1964 through 1973 (excluding 1970, 1971, 1974, and 1975) further reduced this number to 304, which comprised the final data base used in this analysis. The presence of a low-level wind shear was a distinct possibility in 71 of these takeoff, approach, or landing accidents. Of this number, 48 involved mechanically (orographic or topographic) induced shears. In 23 of the cases, thunderstorms were reported or observed close to the aircraft flightpath. Author

N79-28849# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
A NOTE ON THE STATIONARY TROUGH GENERATED BY THE ANDES
Prakki Satyamurty Mar. 1979 15 p refs
(INPE-1429-RPE/008) Avail: NTIS HC A02/MF A01

The permanent trough, off the Andes near the east coast of Brazil, is simulated by integrating the observed mean zonal flow using a primitive equation barotropic model with topographic forcing. The position of the simulated trough agrees well with the mean climatological front and the maximum rainfall area. Author

N79-28850*# Saint Louis Univ., Mo. Dept. of Earth and Atmospheric Sciences.
KINETIC ENERGY BUDGETS IN AREAS OF CONVECTION Final Report, 20 Mar. 1978 - 19 Apr. 1979
Henry E. Fuelberg Aug. 1979 104 p refs
(Contract NAS8-32838)
(NASA-CR-3166) Avail: NTIS HC A06/MF A01 CSCL 04B

Synoptic scale budgets of kinetic energy are computed using 3 and 6 h data from three of NASA's Atmospheric Variability Experiments (AVE's). Numerous areas of intense convection occurred during the three experiments. Large kinetic energy variability, with periods as short as 6 h, is observed in budgets computed over each entire experiment area and over limited volumes that barely enclose the convection and move with it. Kinetic energy generation and transport processes in the smaller volumes are often a maximum when the enclosed storms are near peak intensity, but the nature of the various energy processes differs between storm cases and seems closely related to the synoptic conditions. A commonly observed energy budget for peak storm intensity indicates that generation of kinetic energy by cross-contour flow is the major energy source while dissipation to subgrid scales is the major sink. Synoptic scale vertical motion

transports kinetic energy from lower to upper levels of the atmosphere while low-level horizontal flux convergence and upper-level horizontal divergence also occur. Spatial fields of the energy budget terms show that the storm environment is a major center of energy activity for the entire area. Author

N79-28851# Naval Postgraduate School, Monterey, Calif.
SOME TESTS OF THE PENNSYLVANIA STATE UNIVERSITY MESOSCALE MODEL WITH TROPICAL CYCLONES M.S. Thesis
M. R. Hacunda Dec. 1978 82 p refs
(AD-A067582) Avail: NTIS HC A05/MF A01 CSCL 04/2

A three-dimensional, primitive equation model by Anthes and Warner (1978) was used to predict five typhoon cases. The five-layer model on a 40X40 staggered grid with 120 km resolution included a moisture cycle, sensible and latent heat flux at the earth's surface, and a bulk parameterization of the planetary boundary layer. The model is initialized using operational wind fields and two forms of a wind bogus. Due to the lack of a representative moisture analysis in the vicinity of tropical cyclones, simulated moisture fields were used to initialize the model. Initial experiments conducted with these fields produced widespread convection and heating which developed circulations in areas well removed from the actual storm. The associated modifications to the steering flow, and the overly intense storm circulations resulted in premature recurvature. Use of a second moisture bogus, which provided less available moisture (especially at upper levels), reduced the amount of convection over the entire grid and the effect on the steering current. A second wind bogus was also tested. This technique resulted in a smaller and less intense initial storm, which also resulted in considerably less convection. GRA

N79-28852# Naval Weather Service Detachment, Asheville, N. C.
SUMMARY OF METEOROLOGICAL OBSERVATIONS, SURFACE (SMOS) CHASE FIELD, TEXAS Reference Report, 1945 - 1977
Jul. 1978 367 p refs
(AD-A067678) Avail: NTIS HC A16/MF A01 CSCL 04/2

This data report consists of a six part statistical summary of surface weather observations. The six parts are: Part A - Weather Conditions/Atmospheric Phenomena, Part B - Precipitation/Snowfall/Snow Depth, Part C - Surface Winds, Part D - Ceiling versus Visibility/Sky Cover, Part E - Psychrometric Summaries, and Part F - Station Pressure/Sea Level Pressure.
Author (GRA)

N79-28853# Naval Weather Service Detachment, Asheville, N. C.
SUMMARY OF METEOROLOGICAL OBSERVATIONS, SURFACE (SMOS) BARKING SANDS, HAWAII Reference Report, 1968 - 1976
Jul. 1978 308 p refs
(AD-A067677) Avail: NTIS HC A14/MF A01 CSCL 04/2

This data report consists of a six part statistical summary of surface weather observations. The six parts are: Part A - Weather Conditions/Atmospheric Phenomena, Part B - Precipitation/Snowfall/Snow Depth, Part C - Surface Winds, Part D - Ceiling versus Visibility/Sky Cover, Part E - Psychrometric Summaries, and Part F - Station Pressure/Sea Level Pressure.
Author (GRA)

N79-28854# Naval Weather Service Detachment, Asheville, N. C.
SUMMARY OF METEOROLOGICAL OBSERVATIONS, SURFACE (SMOS) KEY WEST, FLORIDA Reference Report, 1945 - 1977
Jul. 1978 355 p refs
(AD-A067681) Avail: NTIS HC A16/MF A01 CSCL 04/2

This data report consists of a six part statistical summary of surface weather observations. The six parts are: Part A - Weather Conditions/Atmospheric Phenomena; Part B - Precipitation/Snowfall/Snow Depth; Part C - Surface Winds; Part D - Ceiling versus Visibility/Sky Cover; Part E - Psychrometric Summaries; and Part F - Station Pressure/Sea Level Pressure.
Author (GRA)

N79-28855# Naval Weather Service Detachment, Asheville, N. C.
SUMMARY OF METEOROLOGICAL OBSERVATIONS, SURFACE (SMOS) KINGSVILLE, TEXAS Reference Report, 1945 - 1977
Jul. 1978 369 p refs
(AD-A067682) Avail: NTIS HC A16/MF A01 CSCL 04/2

This data report consists of a six part statistical summary of surface weather observations. The six parts are: Part A - Weather Conditions/Atmospheric Phenomena, Part B - Precipitation/Snowfall/Snow Depth, Part C - Surface Winds, Part D - Ceiling versus Visibility/Sky Cover, Part E - Psychrometric Summaries, Part F - Station Pressure/Sea Level Pressure.
Author (GRA)

N79-28856# Naval Weather Service Detachment, Asheville, N. C.
SUMMARY OF METEOROLOGICAL OBSERVATIONS, SURFACE (SMOS). MEMPHIS, TENNESSEE Reference Report, 1945 - 1977
Jul. 1978 377 p
(AD-A067684) Avail: NTIS HC A17/MF A01 CSCL 04/2

This data report consists of a six part statistical summary of surface weather observations. The six parts are: Part A - Weather Conditions/Atmospheric Phenomena, Part B - Precipitation/Snowfall/Snow Depth, Part C - Surface Winds, Part D - Ceiling versus Visibility/Sky Cover, Part E - Psychrometric Summaries, and Part F - Station Pressure/Sea Level Pressure.
Author (GRA)

N79-28857# Air Force Geophysics Lab., Hanscom AFB, Mass.
VARIATION IN GROUND BRIGHTNESS OVER NORTHEASTERN UNITED STATES AS SENSED BY GOES SATELLITES Environmental Research Papers
Thomas J. Keegan 27 Nov. 1978 22 p refs
(AD-A068085; AFGL-TR-78-0290; AFGL-ERP-646) Avail: NTIS HC A02/MF A01 CSCL 04/2

The first step in an investigation of the use of satellite imagery data in automated short-range forecasts of clouds and precipitation is to examine the variation in ground brightness under clear-sky conditions. Bedford, Massachusetts, Albany, New York, Pittsburgh, Pennsylvania, and Dulles International Airport, Viginia, were selected as test sites for the period March to December 1977. Data were corrected for error and noise. Navigation was fine-tuned to an accuracy of 1 to 2 pixels. Average, standard deviation, maximum, minimum and range of brightness were computed over a range of area sizes around each station in order to establish a stable sample size. The statistics stabilized by a 5 x 5 pixel area. Although the number of cases was small, necessitating combining stations, the correlation between brightness and sun angle was high. The slope of the regression curve between these variables was steeper in spring and fall than in summer. Additional data are needed, but it is expected that they will refine rather than revise significantly the present results. Author (GRA)

N79-28858# Oak Ridge Associated Universities, Tenn. Inst. for Energy Analysis.
SIMPLE CLIMATE MODEL WITH NONUNIQUE, SELF-OSCILLATORY SOLUTIONS
R. G. Watts Jan. 1979 27 p refs
(Contract EY-76-C-05-0033)
(ORAU/IEA-79-1(M)) Avail: NTIS HC A03/MF A01

There is strong evidence that the climate of the earth varied substantially over the past millennia. A variety of explanations of this phenomenon appeared in the literature. Many authors attribute the causes of climate change to variations in external parameters, such as changes in the solar constant or volcanic activity. Others invoke changes in the composition of the oceans or of poleward transport of energy by the atmosphere and the oceans as possible causes of ice ages. A simple thermal system that has some of the gross features of an energy balance model of the atmosphere-ocean system is shown to exhibit selfsustained oscillations. For a given solar constant and reasonable values of certain dimensionless parameters, nine stable oscillatory solutions exist. Some possible implications concerning climate variability are discussed. DOE

N79-28859# Research Inst. of National Defence, Stockholm (Sweden).
TESTS OF WIND OBSERVATION WITH PARACHUTES [PROV MED VINDVISERING MOT FALLSKAERM]
Sven Nordstroem and Sture Wickerts May 1978 22 p In SWEDISH
(FOA-C-20238-D2) Avail: NTIS HC A02/MF A01

The parachutes which were used for the wind-measuring tests were previously fired into the air by rockets for other purposes. For the wind tests some of them were specially prepared to give a radar and laser return. The method of determining the wind by tracking a falling parachute was found to be quite usable. However the possibilities of locating a parachute by radar above cloud were not examined. The results show that the parachutes used in this test did not always follow the wind. In some cases independent movement of the parachute was caused by swaying. For any future use of this method it is thought likely that parachutes can be produced which accurately follow the wind. The measures adopted afforded good reflection both for radar and for laser radiation. R.E.S.

N79-28860# National Technical Information Service, Springfield, Va.
HURRICANES FORECASTING, MODIFICATION, AND RESEARCH. A BIBLIOGRAPHY WITH ABSTRACTS
Progress Report, 1964 - Jan. 1979
Edward J. Lehmann and Robena J. Brown Feb. 1979 272 p Supersedes NTIS/PS-78/0028; NTIS/PS-77/0026; NTIS/PS-76/0027; NTIS/PS-75/187
(NTIS/PS-79/0018/6; NTIS/PS-78/0028; NTIS/PS-77/0026; NTIS/PS-76/0027; NTIS/PS-75/187) Avail: NTIS HC $28.00/MF $28.00 CSCL 04B

Citations are presented to research reports covering hurricane modeling, cloud seeding, remote sensing, air water interactions, heat transfer, and wind motion. This updated bibliography contains 265 abstracts, 19 of which are new entries to the previous edition. GRA

N79-28861# Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.
EFFECTS OF POLLUTANTS AND URBAN PARAMETERS ON ATMOSPHERIC DISPERSION AND TEMPERATURE
Final Report, Jan. 1975 - Dec. 1977
R. Viskanta and T. L. Weirich Feb. 1979 145 p refs
(Grant EPA-R-803514)
(PB-294274/6; EPA-600/4-79-012) Avail: NTIS HC A07/MF A01 CSCL 04B

Two dimensional numerical simulations of planetary boundary layer flow indicate that urbanization (increase of surface roughness, changes in surface albedo, and the addition of anthropogenic heat sources) has a greater influence on the urban heat island than the addition of pollutants (gaseous and particulate) which are active in the radiative transfer processes of the heat budget. Although mid-day surface temperatures are decreased by adding such pollutants, temperatures at other times of the day are increased. These simulations also indicate that heat islands are most pronounced with a snow cover on the ground. The warmer surface temperatures enhance low level pollutant dispersal with a consequent 25% concentration reduction. These results indicate that a change in use is an important factor in local climate and weather modification. GRA

N79-28862# Western Weather Consultants, Inc., Durango, Colo.
SUPPORT OBSERVATIONS FOR WEATHER MODIFICATION OPERATIONS IN THE SAN JUAN MOUNTAINS AND A PROCEDURE FOR ESTIMATING SNOWPACK RUNOFF
Final Report, Feb. 1977 - Mar. 1978
Lawrence M. Hjermstad and Richard A. Medenwaldt Jan. 1979 47 p refs Sponsored in part by Southwestern Water Conservation District, Colo. Dept. of Natural Resources and Bureau of Reclamation
(Contract DI-7-07-83-V0005)
(PB-293674/8; WWCI/FR-003) Avail: NTIS HC A03/MF A01 CSCL 04B

Three separate areas of work for the Bureau of Reclamation are presented. The first area of work consisted of a program for obtaining surface precipitation measurements from six recording gages installed and maintained in the San Juan Mountains. The precipitation data collected were reduced and put into a computer compatible format similar to that used on the Colorado River Basin Pilot Project. The second area of work consisted of an evaluation of the usefulness of the Bureau of Reclamation's Environmental Data Network (EDN) for cloud seeding operations. Analyzing the wintertime precipitation and runoff relationships in the San Juan Mountains was the third area of work accomplished. After evaluating data from the 1970-1975 period, an equation was developed that could forecast by mid-May the runoff from the winter's snowpack within approximately five percent of the runoff that was actually observed. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N79-28863*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SEA-SURFACE TEMPERATURE AND SALINITY MAPPING FROM REMOTE MICROWAVE RADIOMETRIC MEASUREMENTS OF BRIGHTNESS TEMPERATURE
C. Blume Hans-Juergen, Bruce M. Kendall, and John C. Fedors Dec. 1977 29 p refs
(NASA-TP-1077; L-11763) Avail: NTIS HC A03/MF A01 CSCL 08J

A technique to measure remotely sea surface temperature and salinity was demonstrated with a dual frequency microwave radiometer system. Accuracies in temperature of 1 C and in salinity of part thousand for salinity greater than 5 parts per thousand were attained after correcting for the influence of extraterrestrial background radiation, atmospheric radiation and attenuation, sea-surface roughness, and antenna beamwidth. The radiometers, operating at 1.43 and 2.65 GHz, comprise a third-generation system using null balancing and feedback noise injection. Flight measurements from an aircraft at an altitude of 1.4 km over the lower Chesapeake Bay and coastal areas of the Atlantic Ocean resulted in contour maps of sea-surface temperature and salinity with a spatial resolution of 0.5 km. Author

N79-28864*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
INVESTIGATION OF EFFECTS OF BACKGROUND WATER ON UPWELLED REFLECTANCE SPECTRA AND TECHNIQUES FOR ANALYSIS OF DILUTE PRIMARY-TREATED SEWAGE SLUDGE
Charles H. Whitlock, J. W. Usry, William G. Witte, Franklin H. Farmer, and E. A. Gurganus Aug. 1979 36 p refs
(NASA-TP-1446; L-12694) Avail: NTIS HC A03/MF A01 CSCL 08J

In an effort to improve understanding of the effects of variations in background water on reflectance spectra, laboratory tests were conducted with various concentrations of sewage sludge diluted with several types of background water. The results from these tests indicate that reflectance spectra for sewage-sludge mixtures are dependent upon the reflectance of the background water. Both the ratio of sewage-sludge reflectance to background-water reflectance and the ratio of the difference in reflectance to background-water reflectance show spectral variations for different turbid background waters. The difference in reflectance in the only parameter considered. Author

N79-28865# Scripps Institution of Oceanography, La Jolla, Calif.
VERTICAL PROFILES OF TEMPERATURE, SALINITY AND DENSITY FROM THE NORPAX POLE EXPERIMENT
R. A. Knox and M. J. McPhaden Apr. 1979 172 p refs
(Contract N00014-75-C-0152)
(AD-A069062; SIO-Ref-79-6) Avail: NTIS HC A08/MF A01 CSCL 08/10

During the NORPAX Pole experiment of January-February 1974, 165 STD casts to 500 m depth were made from R/V Thomas Washington in an area of 100 km radius surrounding 35 deg N, 155 deg W. Temperature data from these casts, together with ship and aircraft XBT data in the same area, have been used to describe the variability of the temperature field

(Barnett, Knox and Weller, 1977). This report presents the final, corrected values of salinity and potential density, as well as temperature, from the SDT casts. In the case of the temperature field, there is no significant difference between the values reported here and those used by Barnett, Knox and Weller. Author (GRA)

51 LIFE SCIENCES (GENERAL)

Includes genetics.

No abstracts in this category.

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N79-28866* National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY. A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 195
Jul. 1979 53 p
(NASA-SP-7011(195)) Avail: NTIS HC E03 CSCL 06E

This bibliography lists 148 reports, articles, and other documents introduced into the NASA scientific and technical information system in June 1979. Author

N79-28867*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
OPERATOR PERFORMANCE AND LOCALIZED MUSCLE FATIGUE IN A SIMULATED SPACE VEHICLE CONTROL TASK
James L. Lewis, Jr. Jun. 1979 83 p refs
(NASA-TM-58220; JSC-16033) Avail: NTIS HC A05/MF A01 CSCL 05H

Fourier transforms in a special purpose computer were utilized to obtain power spectral density functions from electromyograms of the biceps brachii, triceps brachii, brachioradialis, flexor carpi ulnaris, brachialis, and pronator teres in eight subjects performing isometric tracking tasks in two directions utilizing a prototype spacecraft rotational hand controller. Analysis of these spectra in general purpose computers aided in defining muscles involved in performing the task, and yielded a derived measure potentially useful in predicting task termination. The triceps was the only muscle to show significant differences in all possible tests for simple effects in both tasks and, overall, was the most consistently involved of the six muscles. The total power monitored for triceps, biceps, and brachialis dropped to minimal levels across all subjects earlier than for other muscles. However, smaller variances existed for the biceps, brachioradialis, brachialis, and flexor carpi ulnaris muscles and could provide longer predictive times due to smaller standard deviations for a greater population range. Author

N79-28868# Civil Aeromedical Inst., Oklahoma City, Okla.
A LOWER BODY NEGATIVE PRESSURE BOX FOR +Gz SIMULATION IN THE UPRIGHT SEATED POSITION
Michael T. Lategola and Charles C. Trent Feb. 1979 9 p refs
(AD-A069326; FAA-AM-79-8) Avail: NTIS HC A02/MF A01 CSCL 06/19

The cost of purchasing and operating a human centrifuge is substantial. Lower body negative pressure (LBNP) is considered an acceptable experimental substitute for the +Gz stress of the centrifuge. Since civil aviation pilots are usually subjected to +Gz stress in an upright seated position, an upright seated version of the supine LBNP box was developed. In this version, a negative pressure of -40 mm Hg is considered the equivalent of a +2 Gz stress. This box has successfully withstood a test pressure of -120 mm Hg. Pedal ergometry within the box is easily accomplished. The box was anthropometrically engineered to accommodate a human height range of 160-195 cm. Locating the box within an altitude chamber allows the application of LBNP at any level of chamber altitude. Author

N79-28869*# General Electric Co., Philadelphia, Pa.
SKYLAB MEDICAL DATA EVALUATION PROGRAM (SMEDEP)
G. W. Hoffler, C. L. Huntoon, S. L. Kimzey, and J. A. Rummel [1979] 869 p
(Contract NAS9-14523)
(NASA-CR-160279) Avail: NTIS HC A99/MF A01 CSCL 06P

A day-by-day summary of selected data collected during the experiment is presented. The clinical and environmental data are presented in a mission-day format along with a tabulation of biomedical measurements whose values exceed three standard deviations from the preflight measurements. F.O.S.

N79-28870# California Univ., Irvine, Dayton, Ohio.
TOXICITY OF HIGH DENSITY JET FUEL COMPONENTS Final Report
C. C. Haun, J. D. MacEwen, and E. H. Vernot Wright-Patterson AFB, Ohio AMRL Apr. 1978 29 p refs
(Contract F33615-76-C-5005; AF Proj. 6302)
(AD-A068596; AMRL-TR-78-16) Avail: NTIS HC A03/MF A01 CSCL 06/20

Two constituents of a synthetic jet engine fuel were evaluated for toxicologic effects. These constituents of JP-9 fuel were perhydromethylcyclopentadiene (RJ-4) and bicycloheptadiene (RJ-5). Excess tumor lesions over control levels were seen in a small number of rats and mice held for a one year observation period following six months repeated daily inhalation exposures to RJ-5. Author (GRA)

N79-28871# Naval Air Development Center, Warminster, Pa.
THERMAL CONDUCTION EFFECTS IN HUMAN SKIN. 1: EXPERIMENTAL DATA ACQUISITION
M. A. Chianta, A. M. Stoll, and J. R. Piergallini 15 Jan. 1979 19 p refs
(AD-A068479; NADC-79033-60) Avail: NTIS HC A02/MF A01 CSCL 06/16

To determine the maximum permissible temperature any material may attain without causing pain or burn on contact with bare skin, over 2000 observations were made of pain threshold during contact with materials at elevated temperatures. Six materials were used representing the full range of thermal properties of good conductors to good insulators. Initial specimen and skin temperatures, interface (material-skin) temperatures throughout contact, and time to pain threshold were noted. An orderly relationship was found between pain threshold and material temperature, either longer exposures or higher specimen temperatures being associated with better insulative properties. Variations in thickness of the epidermis affect these times and temperatures so that families of curves are generated from data obtained at sites of increasing thickness. On the basis of the relationship demonstrated between pain sensation and thermal properties the material temperature which will cause a blister on contact may be predicted. Author (GRA)

N79-28872# Naval Air Development Center, Warminster, Pa.
THERMAL CONDUCTION EFFECTS IN HUMAN SKIN. 3: INFLUENCE OF EPIDERMAL THICKNESS AND EXPOSURE TIME
A. M. Stoll, J. R. Piergallini, and M. A. Chianta 15 Jan. 1979 26 p refs
(AD-A068481; NADC-79035-60) Avail: NTIS HC A03/MF A01 CSCL 06/16

Empirical data relating temperatures and thermal properties of materials to pain and blister end points have provided graphs and equations for predicting safe temperatures for any material in contact with bare skin for 1 to 5 seconds solely from a knowledge of its thermal properties. Conversely, the thermal inertia (kpc) of the optimal material for a specific use, and safe skin contact, can be predicted from a knowledge of the maximum material temperature and the length of contact time anticipated. Increasing epidermal thickness causes can cause orderly elevation of the material temperature at pain threshold at fixed contact times, or lengthened contact times at fixed material temperatures, as indicated in the graphs and equations. The data base and procedures described provide a simple means of evaluating the thermal safety of materials in contact with bare skin and pre-determining the krhoc required for such safety in selecting

suitable materials in myriad construction and manufacturing applications. Author (GRA)

N79-28873# Oak Ridge National Lab., Tenn.
DOSE-RATE CONVERSION FACTORS FOR EXTERNAL EXPOSURE TO PHOTON AND ELECTRON RADIATION FROM RADIONUCLIDES OCCURRING IN ROUTINE RELEASES FROM NUCLEAR FUEL CYCLE FACILITIES
D. C. Kocher Feb. 1979 181 p refs
(Contract W-7405-eng-26)
(NUREG/CR-0494; ORNL/NUREG/TM-283) Avail: NTIS HC A09/MF A01

Dose-rate conversion factors for immersion in contaminated air, immersion in contaminated water, and exposure to a contaminated ground surface were estimated for tissue equivalent material at the body surface of an exposed individual. For each exposure mode, photon dose-rate conversion factors were also estimated for 22 body organs. The calculations assumed that the contaminated air, water, and ground surface were infinite in extent and that the radionuclide concentration was uniform. Dose-rate conversion factors for immersion in contaminated air and water were based on the requirement that all energy emitted in the decay of a radionuclide was absorbed in the infinite medium. Dose-rate conversion factors for ground surface exposure was calculated for a height of 1 m using the point-kernel integration method and known specific absorbed fractions for photons and electrons in air. The computer code written to perform the calculations is described and documented. DOE

N79-28874# National Technical Information Service, Springfield, Va.
CARDIOVASCULAR DISEASES, VOLUME 3. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Mar. 1977 - Feb. 1979
Elizabeth A. Harrison Mar. 1979 147 p Supersedes NTIS/PS-78/0103; NTIS/PS-77/0095; NTIS/PS-76/0118; NTIS/PS-75/264
(NTIS/PS-79/0063/2; NTIS/PS-78/0103; NTIS/PS-77/0095; NTIS/PS-76/0118; NTIS/PS-75/264) Avail: NTIS HC $28.00/MF $28.00 CSCL 06E

Research reports are cited on the epidemiology, etiology, risk factors, prevention, diagnosis, pathology, therapy, surgery, and rehabilitation of cardiovascular diseases. Reports on cardiac assist devices, health services, and facilities were excluded. GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N79-28875 Arizona Univ., Tucson.
STRESS MANAGEMENT: A COMPARISON OF EDUCATIONAL, AEROBIC AND AUTOSUGGESTIVE APPROACHES Ph.D. Thesis
Sandra Mary Sylvester 1979 71 p
Avail: Univ. Microfilms Order No. 7914432

Three commonly used procedures for managing stress: (1) stress education, (2) aerobics, and (3) autosuggestion as to their relative effectiveness are analyzed. The use of education for stress management is based on a common belief that if one is informed about the nature of stress and taught specific procedures to cope more effectively with stress, then a rational person will utilize these procedures to reduce his personal stress level. The aerobics procedure which emphasizes physical exercise is a system of strengthening the cardiovascular and respiratory systems. In autosuggestion or self-hypnosis, subjects are taught to couple deep psychophysiological relaxation with ego strengthening suggestions regarding strengths and competencies in handling stress. The results indicated participants in the treatment groups significantly reduced their levels of trait anxiety over controls, the most effective being autosuggestion, followed by aerobics and then stress education. Dissert. Abstr.

N79-28876 Missouri Univ. - Columbia.
SELECTIVE ATTENTION: THE INFLUENCES OF SUBJECT SEX AND DEGREE OF PRIOR HABITUATION ON PERFORMANCE OF AN ATTENTION TASK WITH DISTRACTION Ph.D. Thesis
Elizabeth Anne Beck 1978 118 p
Avail: Univ. Microfilms Order No. 7915211

An investigation was performed to determine: (1) whether varying the degree of prior habituation of the phasic orienting response (OR) to stimuli which were later to be used as distractors in an attention demanding task, would influence task performance and reduce OR frequency to distractors during the task; and (2) if there were sex differences in the effects of this prior habituation as well as sex differences in performance with distraction. The task was the solution of mathematical problems from immediate memory, and the distractors were random numbers and mathematical signs. The data did not support, in fact was contrary to, the hypothesis that females are more distractible than males. Dissert. Abstr.

N79-28877# Naval Postgraduate School, Monterey, Calif.
DEVELOPMENT OF INFORMATION THEORY CONCEPTS AND EQUATIONS FOR HUMAN MENTAL PROCESSING M.S. Thesis
Jose Alberto Martinez Mar. 1979 34 p refs
(AD-A068606) Avail: NTIS HC A03/MF A01 CSCL 09/4

This report presents the research and analysis accomplished in order to develop new concepts of information theory and new equations that could allow the researcher to compute with more precision, the amount of information processed by a subject during the execution of a sequential mental task. A very sophisticated piece of equipment was used in order to simulate a sequential task of military nature. The results of the experiment proved that new equations to compute the amount of information processed should be used when the task to be performed implies that the operator has to go through different levels of 'thinking' before he reacts to a stimulus. Author (GRA)

N79-28878# New Mexico Univ., Albuquerque. Technology Application Center.
STRESS FACTORS ON PILOT PERFORMANCE. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1974 - Jan. 1979
Gerald F. Zollars Jun. 1979 27 p Sponsored by NTIS
(NTIS/PS-79/0506/0) Avail: NTIS HC $28.00/MF $28.00 CSCL 05J

Articles on biological aspects of flight, stress, psychophysiology, acceleration stresses, flight, fitness, and physiological effects and responses are presented. This bibliography contains 100 citations. GRA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N79-28879 Ohio State Univ., Columbus.
COMBINED DISCRETE NETWORK-CONTINUOUS CONTROL MODELING OF MAN-MACHINE SYSTEMS Ph.D. Thesis
Deborah Jayne Roeckner Seifert 1979 204 p
Avail: Univ. Microfilms Order No. 7916025

The role of the human operator in control systems is evolving towards that of a supervisor who plans, sequences, and monitors away from strictly tracking. New modeling approaches and techniques are required to realistically represent and examine these new system configurations and resulting performance issues. An alternate modeling approach comprised of discrete network models in combination with elements of an open-loop optimal control model formulation was proposed. The feasibility of employing this combined modeling approach was demonstrated through its application to the DAIS (Digital Avionics Information System) system in which pilot duties involve information retrieval and cognitive processing tasks in addition to flight control.
Dissert. Abstr.

N79-28880*# Massachusetts Inst. of Tech., Cambridge. Dept. of Nutrition and Food Science.
MAXIMIZING STORAGE STABILITY OF FOODS TO BE USED FOR RESUPPLY IN A CONTROLLED ECOLOGICAL LIFE SUPPLY SYSTEM: EVALUATION OF RESEARCH
M. Karel, I. Saguy, R. Villota, and H. D. Heidelbaugh Jul. 1979 187 p refs
(Grant NsG-2334)
(NASA-CR-158846) Avail: NTIS HC A09/MF A01 CSCL 06H

The state of the art and research needs of storage stability of dehydrated foods were evaluated. A critical literature review is also included. R.E.S.

N79-28881*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INTRAOCULAR PRESSURE REDUCTION AND REGULATION SYSTEM
Edward F. Baehr, James E. Burnett, Sanford F. Felder, and William J. McGannon 1979 14 p Presented at Symp. on Glaucoma Surgery, Detroit, 17-18 May 1979
(NASA-TM-79187; E-038) Avail: NTIS HC A02/MF A01 CSCL 06E

An intraocular pressure reduction and regulation system is described and data are presented covering performance in: (1) reducing intraocular pressure to a preselected value, (2) maintaining a set minimum intraocular pressure, and (3) reducing the dynamic increases in intraocular pressure resulting from external loads applied to the eye. Author

N79-28882# Aeronautical Research Labs., Melbourne (Australia).
COLD WATER SURVIVAL SUITS FOR AIRCREW
G. R. White Mar. 1978 27 p refs
(ARL/Sys-Note-56; AR-001-119) Avail: NTIS HC A03/MF A01

Laboratory and sea trials were used to evaluate the effectiveness of three aircrew cold water survival garments: the British Mark 10 suit, the United States CWU 21/P suit, and the Canadian U.VIC Thermofloat jacket. It was concluded that the three alternatives provided similar thermal protection but with regard to several other important features, the U.VIC Thermofloat jacket was superior. Consequently, in this evaluation the U.VIC Thermofloat jacket was shown to provide the most effective form of aircrew protection. Author

N79-28883*# Life Systems, Inc., Cleveland, Ohio.
TECHNOLOGY ADVANCEMENT OF AN OXYGEN GENERATION SUBSYSTEM Final Report
M. K. Lee, K. A. Burke, F. H. Schubert, and R. A. Wynveen May 1979 78 p refs
(Contract NAS2-9795)
(NASA-CR-152257; LSI-ER-336-4) Avail: NTIS HC A05/MF A01 CSCL 06K

An oxygen generation subsystem based on water electrolysis was developed and tested to further advance the concept and technology of the spacecraft air revitalization system. Emphasis was placed on demonstrating the subsystem integration concept and hardware maturity at a subsystem level. The integration concept of the air revitalization system was found to be feasible. Hardware and technology of the oxygen generation subsystem was demonstrated to be close to the preprototype level. Continued development of the oxygen generation technology is recommended to further reduce the total weight penalties of the oxygen generation subsystem through optimization. R.E.S.

N79-28884# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
CREW WORKLOAD ASSESSMENT. DEVELOPMENT OF A MEASURE OF OPERATOR WORKLOAD Final Technical Report, 15 Jun. 1977 - 1 Sep. 1978
James D. Wolf Dec. 1978 93 p refs
(Contract F33615-77-C-3065)
(AD-A068616; HONEYWELL-78SRC74; AFFDL-TR-78-165) Avail: NTIS HC A05/MF A01 CSCL 01/2

The study objective was to develop a quantitative measure of workload useful in crewstation evaluation. Flight tasks of varying difficulty were simulated, and 35 pilot response variables analyzed. Selected physiological and visual response variables were applied in a stepwise regression procedure to the prediction of a composite performance/opinion measure, which reflected differing levels of task difficulty. The resulting linear equation was reformulated as a preliminary operationally-defined measure of information-processing workload. Author (GRA)

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering*.

N79-28885 Illinois Univ. at Urbana-Champaign.
MINIMUM MEAN RUNNING TIME FUNCTION GENERATION USING READ ONLY MEMORY Ph.D. Thesis
Gilles Henri Garcia 1979 240 p
Avail: Univ. Microfilms Order No. 7915350

A method for generating functions using a minimum mean running polynomial approximation is presented in hardware implementations. With the advent of VLSI, Read Only Memories may be used to store many constants very economically. In addition, large multipliers are now available which multiply two n-bit numbers in O(n) or O(logn) time. Multiplication is considered as the basic operator. The method consists of splitting the interval (a,b) into several large partitions. Within each large partition, the function f(x) is evaluated in a large number of small subintervals using an approximating polynomial of very low degree. The coefficients of the polynomials are stored in ROMs. A set of partitions of (a,b) is defined such that the polynomials have the same degree within each partition. The optimal determination of the partition is obtained by solving the nonlinear programming problem where the objective is the minimization of the average number of multiplications over the whole range, assuming a logarithmic distribution of the mantissas of floating-point numbers, and the cost constraint is the maximum number of ROM words available. Dissert. Abstr.

N79-28886 North Carolina Univ. at Chapel Hill.
THE DESIGN OF A COMPUTER SYSTEM WITH ALL-ELECTRONIC FILES Ph.D. Thesis
Thomas Heber Dunigan, Jr. 1978 148 p
Avail: Univ. Microfilms Order No. 7914342

A computer memory device is postulated and its hardware/software implications are investigated. The current uses of mass memories are investigated, and a set of device parameters that would serve these uses is described. Alternative architectures for interfacing the new device to the central processing unit are analyzed. The analysis shows that treating the device in a cache-like memory hierarchy yields the most desirable configuration. Dissert. Abstr.

N79-28887 Ohio State Univ., Columbus.
EXPERIMENTAL DESIGN FOR COMPUTER COMPARISON AND SELECTION Ph.D. Thesis
Paul David Amer 1979 296 p
Avail: Univ. Microfilms Order No. 7915948

A formal statement of the computer comparison problem is presented and a first step towards the development of a full scientific methodology for the solution of that problem is provided. A comparison effort is an attempt to estimate the relative merits of a set of alternatives. In computer comparisons these alternatives may be (but are not limited to) scheduling algorithms, hardware components, compilers, or large scale computer systems. A formal model of the computer selection process is proposed where the alternatives being compared are not limited to computer systems, but include any set of computer-related alternatives. Several experimental designs and the statistical (ranking and selection) theory on which they are justified are presented. Following their presentation, the designs are applied in an actual case study in which four interactive computer services are compared.
Dissert. Abstr.

N79-28888 Illinois Univ. at Urbana-Champaign.
METHODS FOR CONSTRUCTING PARALLEL COMPILERS FOR USE IN A MULTIPROCESSOR ENVIRONMENT Ph.D. Thesis
Richard Marion Schell, Jr. 1979 213 p
Avail: Univ. Microfilms Order No. 7915422

Methods for adapting compiler technology to produce compilers written as a set of concurrent processes, to be used in multiprocessor environments are explored. A model for parallel compilers based on the replication of processes and which discusses methods of implementing the model is presented. A method for performing parallel lexical analysis is given. The method is based on a two phase scanner. A technique for parallel parsing, piecewise LR parsing, is developed and coupled with a scheme for parallel syntax error recovery. A family of attribute grammar evaluators is described. These evaluators, parallel treewalk evaluators, are used to provide parallelism in the semantic analysis and translation phases of compilation. Dissert. Abstr.

N79-28889 Illinois Univ. at Urbana-Champaign.
IMPROVING THE PERFORMANCE OF VIRTUAL MEMORY COMPUTERS Ph.D. Thesis
Walid Abdul-Karim Abu-Sufah 1979 260 p
Avail: Univ. Microfilms Order No. 7915307

A model for the ideal behavior of a program in a virtual memory system is developed. Algorithms for compiler transformations are designed to force FORTRAN like programs to follow this model. The transformations serve the additional purpose of reducing the cost of execution of a program after it is made to follow the model. Preliminary experimental results show that transformed programs are easier to model, simpler to manage, and cheaper to execute. The results show that the transformations have the potential of improving the throughput of a multiprogrammed system by an order of magnitude and the degree of multiprogramming by a factor of five. Very simple memory management policies (like the LRU policy) seem to do as well, and even better than elaborate policies (like the Working Set policy) in managing transformed programs. Some measurements of the Working Set anomalies in FORTRAN programs are discussed. Dissert. Abstr.

N79-28890# Computer Corp. of America, Cambridge, Mass.
A DISTRIBUTED DATABASE MANAGEMENT SYSTEM FOR COMMAND AND CONTROL APPLICATIONS Semiannual Technical Report, 1 Jul. - 31 Dec. 1978
30 Jan. 1979 152 p refs
(Contract N00039-77-C-0074)
(AD-A068161; CCA-79-12; SATR-4) Avail: NTIS HC A08/MF A01 CSCL 09/2

The primary focus of this project is to design and implement a distributed database management system called SDD-1 (System for Distributed Databases). SDD-1 is specifically oriented toward command and control applications and will be installed and tested in the Advanced Command and Control Architectural Testbed at the Naval Ocean Systems Center in San Diego. SDD-1 is a system for managing databases whose storage is distributed over a network of computers. Functionally, SDD-1 provides the same capabilities that one expects of any modern database management system, and users interact with it precisely as if it were not distributed. Systems like SDD-1 are appropriate for applications which exhibit two characteristics: (1) the activity requires an integrated database -- i.e. the activity entails access to a single pool of information by multiple persons, organizations, or programs; and (2) either the users of the information or its sources are distributed geographically. Military command and control exhibits these two characteristics. GRA

N79-28891# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
A MACHINE ARCHITECTURE TO SUPPORT AN OBJECT-ORIENTED LANGUAGE Ph.D. Thesis
Alan Snyder Mar. 1979 175 p refs
(Contract N00014-75-C-0661)
(AD-A068111; MIT/LCS/TR-209) Avail: NTIS HC A08/MF A01 CSCL 09/2

In object-oriented languages (e.g., LISP, Simula, and CLU), all (or most) data objects used by a program are implicitly allocated from a free-storage area and are accessed via fixed-size references. The storage for an object is automatically reclaimed (garbage collected) when the object is no longer accessible to the program. This thesis presents the design of a computer system that directly supports an object-oriented machine language. The machine provides a single, large universe of objects shared by multiple processes. The design uses expected future technologies (fast-access secondary storage devices and inexpensive processors) to satisfy the goals of good performance and a simple, modular system organization. Automatic storage reclamation is performed primarily using reference counts. The proposed reference count implementation reduces the time overhead of automatic storage reclamation and allows most reclamation processing to be performed in parallel with normal computation. In addition, the reference count scheme can be used in a multiprocessor configuration without introducing complex synchronization problems. A proposed implementation of the machine is described in terms of a number of specialized processor modules communicating via messages. Multiple processors are used to improve performance and to achieve a more modular system structure. GRA

N79-28892# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
EXTENSIONS TO DEC TOPS-20 OPERATING SYSTEM Final Technical Report, 1 Sep. 1977 - 31 Dec. 1978
R. Thomas Jan. 1979 16 p refs
(Contract N00014-77-C-0490; ARPA Order 2901)
(AD-A068115; BBN-4041) Avail: NTIS HC A02/MF A01 CSCL 09/2

This report describes modifications made to the TOPS-20 operating system in order to enable ARPA research programs previously supported by the TENEX operating system to be supported by TOPS-20. In addition, it describes modifications to the ARPANET network control programs (NCPs) for both TENEX and TOPS-20 to enable those hosts to use the 'new style' extended host/IMP leaders. The changes to TOPS-20 have been delivered to DEC and merged with the standard DEC version of the system, and will be maintained by DEC along with the rest of the system. GRA

N79-28893# Computer Corp. of America, Cambridge, Mass.
DATACOMPUTER AND SIP OPERATIONS Final Technical Report for period ending 1978
Donald E. Eastlake, III, Matthew Maltzman, and Joanne Z. Sattley 30 Mar. 1979 83 p refs
(Contract N00039-78-C-0246; ARPA Order 3540)
(AD-A068608; CCA-79-11) Avail: NTIS HC A05/MF A01 CSCL 09/2

During 1978, Computer Corp. of America offered very large on-line data storage and retrieval services on the Datacomputer in support of the seismic community data activities and for general use. The Datacomputer is a system designed to allow convenient and timely access to large on-line databases for multiple remote users communicating over a network. The Datacomputer is only operational general purpose database system capable of handling data sets in excess of a trillion bits. Copious and inexpensive storage is a unique feature of the CCA Datacomputer, made possible by the incorporation of an Ampex Tera-Bit Memory

System (TBM). The TBM at CCA was the first public installation of this video-tape technology based system. The CCA installation is configured to hold up to 175 billion bits on-line with four TBM tape drives. Additional data (almost entirely seismic) is stored in off-line TBM. GRA

N79-28894# Lincoln Lab., Mass. Inst. of Tech., Lexington.
TWO WAYS TO INTERFACE A MOTOROLA M6800 MICROPROCESSOR TO A MODCOMP COMPUTER
Lawrie E. Eaton 22 Feb. 1979 33 p refs
(Contract F19628-78-C-0002; AF Proj. 2128)
(AD-A069094; ESD-TR-79-29) Avail: NTIS HC A03/MF A01 CSCL 09/2

Two interfaces have been developed between a Motorola M6800 microprocessor and a ModComp computer. One interface uses a word by word handshaking-interrupt design to control the main telescope at the GEODSS ETS. The other interface uses a stringed message transfer for communication to the microprocessor development system. Both interfaces are described in this report. GRA

N79-28895# Wisconsin Univ. - Madison. Mathematics Research Center.
THE INTERVAL ARITHMETIC PACKAGE: MULTIPLE PRECISION VERSION Technical Summary Report
J. M. Yohe Jan. 1979 16 p refs
(Contract DAAG29-75-C-0024)
(AD-A068930; MRC-TSR-1908) Avail: NTIS HC A02/MF A01 CSCL 09/2

This report describes the multiple precision version of the interval arithmetic package documented in MRC Technical Summary Report no. 1755. The multiple precision version, based on the FORTRAN multiple precision arithmetic package of Brent, is extremely portable. It is assumed that the reader has access to TSR no. 1755, which provides the basic documentation for the interval arithmetic package; the current report addresses only those aspects of the multiple precision version which are not covered in the basic documentation. GRA

N79-28896# IIT Research Inst., Chicago, Ill.
LSI/MICROPROCESSOR RELIABILITY PREDICTION MODEL DEVELOPMENT Final Technical Report, Oct. 1977 - Nov. 1978
H. C. Rickers Mar. 1979 107 p refs
(Contract F30602-77-C-0223; AF Proj. 2338)
(AD-A068911; RADC-TR-79-97) Avail: NTIS HC A06/MF A01 CSCL 09/2

This report presents updated reliabilty prediction models for LSI, microprocessor and memory devices for inclusion in MIL-HDBK-217B, 'Reliability Prediction of Electronic Equipment'. The models proposed in this study possess all those qualities common to practical reliability assessment techniques. The expressions are relatively simple and allow for consideration of evolving fabrication techniques, or emerging technologies, through the modification of temperature dependency and associated temperature factors. The factors exhibit the appropriate discriminations against the device design and usage attributes which contribute to known failure mechanisms. Additionally, each of the models demonstrate reasonable accuracy over the total range of parameters considered in these techniques. GRA

N79-28897# Ohio State Univ., Columbus. Computer and Information Science Research Center.
THE CLUSTERING AND SECURITY MECHANISMS OF DATABASE COMPUTER (DBC)
Jayanta Banerjee, David K. Hsiao, and Jaishankar Menon 6 Apr. 1979 118 p refs
(Contract N00014-75-C-0573)
(AD-A068815; OSU-CISRC-TR-79-2) Avail: NTIS HC A06/MF A01 CSCL 05/2

The database computer (DBC) is a specialized back-end computer which is capable of managing data of 10 to the 10th power bytes in size and supporting known data models such as relational, network, hierarchical and attributed-based models. It is also one of the first database machines to have a built-in security mechanism for access control and a clustering mechanism for performance enhancement. In this report, we demonstrate how the important and essential functions of access control and clustering are carried out in DBC. Since these functions are carried out mostly in the database command and control processor (DBCCP) and the security filter processor (SFP), the report will be devoted largely to these two components of DBC. GRA

N79-28898# Bendix Corp., Kansas City, Mo.
MICROPROCESSOR CIRCUIT MONITOR Final Report
D. J. Stevens Feb. 1979 25 p Revised
(Contract EY-76-C-04-0613)
(BDX-613-2072-Rev) Avail: NTIS HC A02/MF A01

A new laboratory capability was developed which will be used to support some microprocessor based products such as an electronic programmer. The monitor system allows the user to select samples from the instruction set of the microprocessor product under test and verify its progress through those instructions during a test run. The monitor records the time when each selected instruction is addressed and prints out a record of address and time data when a run is complete. These capabilities provide a significant diagnostic tool for investigating a microprocessor malfunction. As an example, the monitor system was successfully used to locate and identify a change that had been made to the instruction set of an electronic programmer. The monitor system is designed to test specific products. The concept, however, may be applied to other microprocessor based products. DOE

N79-28899# National Bureau of Standards, Washington, D. C.
COMPUTER SCIENCE AND TECHNOLOGY: COMPUTERS IN THE FEDERAL GOVERNMENT: A COMPILATION OF STATISTICS, 1978
Martha Mulford Gray Apr. 1979 102 p refs
(PB-294041/9; NBS-SP-500-46; LC-79-600023) Avail: NTIS HC A06/MF A01 CSCL 09B

A combination of existing statistics from Federal Government and computer industry sources and original statistics based on these sources is reported. Data are included on numbers of computers installed in the Federal Government, dollar value of computer installed, numbers of computers installed by agency, Federal ADP costs by agency, Federal computers by acquisition date, and Federal ADP work-years. A detailed analysis is presented for Federal computers classifying the computers into three major categories, general minicomputers. Federal computers are compared with U.S. computers in the same categories. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N79-28900 Purdue Univ., Lafayette, Ind.
A MINICOMPUTER BASED INTERACTIVE GRAPHICS COMPUTER SYSTEM WITH ILLUSTRATIVE APPLICATION TO STRUCTURAL DATA ANALYSIS Ph.D. Thesis
Gregory Robert Guthrie 1978 290 p
Avail: Univ. Microfilms Order No. 7914902

The system is developed for a stand alone capability to provide an analysis tool for direct use by analysts in engineering applications with a minimal requirement of effort or computer graphics education. Emphasis is placed on the structure of the software system interface to the user and providing a concise yet flexible access to the graphics capabilities. The results provide a design structure and format which is capable of handling general classes of interactive graphics applications, although primarily intended for vector oriented data presentation and manipulation uses. The graphics software system presented is specific to the computer hardware system on which it is developed, but the design architecture, user interface format, and concepts are generally applicable to any computer graphics system. An illustrative example is given by a program for analysis of structural response data, demonstrating some of the specialized types of data analysis applications possible with the system.
Dissert. Abstr.

N79-28901 Kansas State Univ., Manhattan.
A MODEL OF EXTENSIBLE-CONTRACTIBLE LANGUAGES

AND THEIR TRANSLATORS Ph.D. Thesis
Gary Glenn Anderson 1978 245 p
Avail: Univ. Microfilms Order No. 7915159

A model was developed which describes the dynamic nature of extensible programming languages and their translators. The model describes the structure and operations necessary to contract an extended language and its translator. The model describes those portions necessary for extension, retention, and contraction of extended features. The approach of modeling only the extension, retention, and contraction features of a language and its translator allows the model to be used in conjunction with all extensible languages. The terminology and a formal notation are developed which describe extension techniques and implementation methods. An extensible-contractible language and its translator are developed and used to show the feasibility of contracting an extended language. Performance experiments are given which isolate the relative efficiencies of extensible-contractible translators. Dissert. Abstr.

N79-28902 Carnegie-Mellon Univ., Pittsburgh, Pa.
STATISTICAL METHODS IN ALGORITHM DESIGN AND ANALYSIS Ph.D. Thesis
Bruce Warren Weide 1978 190 p
Avail: Univ. Microfilms Order No. 7909881

The use of statistical methods in the design and analysis of discrete algorithms is explored. Among the design tools are randomization, ranking, sampling and subsampling, density estimation, and 'cell' or 'bucket' techniques. The analysis techniques include those based on the design methods as well as the use of stochastic convergence concepts and order statistics. Dissert. Abstr.

N79-28903 University of Southwestern Louisiana, Lafayette.
A REALIZATION OF RELATIONAL SEMANTICS IN AN AUTOMATIC PROGRAMMING SYSTEM Ph.D. Thesis
Edward Paul Katz 1978 134 p
Avail: Univ. Microfilms Order No. 7915004

The modeling and realization of relational semantics within a nonprocedural language of an automatic programming system are discussed. The ideal environment for such a language would support data driven, asynchronously parallel processing while still exhibiting relational capabilities. A computational model which spans current data driven and relational models is presented. A prototype nonprocedural programming system is described using the suggested model to realize relational semantics. A comparison of processing effort is made. The implications of these results are applied to designing programming language environment frameworks with the intent of realizing very high level, nonprocedural languages. Dissert. Abstr.

N79-28904 North Carolina Univ. at Chapel Hill.
A ROUTING NETWORK FOR A MACHINE TO EXECUTE REDUCTION LANGUAGES Ph.D. Thesis
David Roger Kehs 1978 170 p
Avail: Univ. Microfilms Order No. 7914372

A network of cells arranged to form a binary tree with connections between horizontally adjacent cells is investigated. Properties of shortest paths between leaf cells in such a network are established. Algorithms are developed to broadcast copies of a data item from one of the leaf cells to other leaf cells of the network. Using different types of guiding information stored in the cells, these algorithms are modified to avoid broadcasting copies to cells which do not need them. Analysis shows that, at best, these algorithms require omega(n) steps to accomplish such patterns as reversal, transposition, or translation of the contents of n leaf cells. Dissert. Abstr.

N79-28905 Iowa State Univ. of Science and Technology, Ames.
A COMPARISON OF AUTOMATA-THEORETIC AND ALGEBRAIC APPROACHES TO TREE TRANSDUCTION AND THE USE OF ALGEBRAIC TREE TRANSDUCERS IN SEMANTIC-PRESERVING TRANSLATIONS Ph.D. Thesis
Kathryn Yuhas Kwinn 1979 97 p
Avail: Univ. Microfilms Order No. 7916202

Desirable properties for algebraic tree transducers are presented which have full and uniquely decomposable domains and semantic preserving. Conditions under which these properties are achievable are discussed, and a procedure is given for constructing an algebraic tree transducer having these properties. Dissert. Abstr.

N79-28906 Syracuse Univ., N. Y.
SYNDROME DECODING Ph.D. Thesis
Louise Dorothy Nielsen 1978 134 p
Avail: Univ. Microfilms Order No. 7914239

The operation and performance of two techniques for error correction are described. The first technique, Syndrome Vote Decoding, attacks error correction from the hard-decision view but utilizes the real (non-digitized) received sequence values to resolve ambiguity. The second technique, Syndrome Gradient Decoding, is a totally soft decision approach to error correction. A function of the received sequence which takes its minimum value for a codeword is defined and error correction is attempted by making modifications in the received sequence which drive this function to its minimum. The performance and applicability of these techniques is discussed and areas for further research are suggested. Dissert. Abstr.

N79-28907 Purdue Univ., Lafayette, Ind.
SYNTACTIC SHAPE RECOGNITION USING ATTRIBUTED GRAMMARS Ph.D. Thesis
Kai-Ching C. You 1978 268 p
Avail: Univ. Microfilms Order No. 7914988

A syntactic approach is applied to the shape description and recognition. The structure of a shape is described by grammatical rules and the local details by primitives. Four attributes are proposed to describe an open curve segment, and the angle between two consecutive curve segments is used to describe the connection. The property of the attributes and the recognition capability of this method were studied. The recognition system was implemented and tested on the recognition of airplane shapes. The grammatical inference procedures for shape grammars are developed. The shape grammars are inferred automatically, interactively or manually directly from the noisy vector patterns. Although this approach was only tested on airplane shapes, the results are applicable to more general shape analysis problems. Dissert. Abstr.

N79-28908 Purdue Univ., Lafayette, Ind.
COMPUTER CONTROL OF A TRAINABLE MANIPULATOR Ph.D. Thesis
Chun-Sing George Lee 1978 168 p
Avail: Univ. Microfilms Order No. 7914924

A computer control algorithm utilizing the modern control theory and the heuristic artificial intelligence approach was developed to control the MIT Scheinman electric arm. A task directed command is recognized, interpreted, and decoded into sequences of subtasks. The first subtask corresponds to the motion of the wrist which is controlled by the suboptimal feedback controller. The remaining four subtasks are further broken down into combinations of six primitive movements which govern the position/orientation of the hand. The heuristic planning and limited decision making of the subtasks are carried through the pattern recognition and artificial intelligence approach. Results from the actual real time implementation of the algorithm on the AARL MIT arm are included. Dissert. Abstr.

N79-28909 Illinois Univ. at Urbana-Champaign.
A SYSTEM FOR PROGRAMMING AND CONTROLLING SENSOR-BASED ROBOT MANIPULATORS Ph.D. Thesis
Clifford Calvin Geschke 1979 107 p
Avail: Univ. Microfilms Order No. 7915351

A Robot Servo System (RSS) which is based upon the following concepts: (1) the programmer directly specifies sampled-data servos which establish links between sensory information and manipulator action; (2) servos for controlling the two spatial aspects (position and orientation) and the two kinesthetic aspects (force and torque), may be specified independently and any conflicts between the various servos are automatically resolved; (3) any of the servos may use whatever sensory data is desired; and (4) manipulator positions are specified as the coincidence of some reference point with a goal. Orientation is specified as the alignment of vectors. Using this system, a programmer may specify powerful sensor driven robot tasks in a manner which corresponds closely to his

intuitive ideas about how the task should be performed.
Dissert. Abstr.

N79-28910# Computer Sciences Corp., Silver Spring, Md.
CENTRAL FLOW CONTROL MANAGEMENT AIDS CODE AUDITOR (MACA) PDL AND PROLOGUE Final Report
Jan. 1979 25 p refs
(Contract DOT-FA77WA-3955)
(AD-A069876; CSC/SD-78/6160; FAA-RD-79-37) Avail: NTIS HC A02/MF A01 CSCL 09/2

The functions of the PDL/Prologue Analysis programs and the procedures required to exercise them are described. These programs provide analysis of module prologues and program design language (PDL) as part of the central flow control (CFC) quality assurance (QA) program, which assures accuracy, completeness, and adherence to project standards and guidelines. F.O.S.

N79-28911*# National Aeronautics and Space Administration, Washington, D. C.
ALGORITHMS FOR THE DETERMINATION OF THE TIME DELAYS OF THE SIGNAL WHEN USING UNEQUAL DETECTORS
B. L. Novak Jul. 1979 19 p refs Transl. into ENGLISH of "Algoritmy Opredeleniya Vremennykh Zapazdyvanii Signala Pri Ispolzovanii Neodinakovykh Detektorov", Rept. Pr-413 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1978 p 1-18 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75646; Pr-413) Avail: NTIS HC A02/MF A01 CSCL 09B

In treating the recorded results from detectors at different locations in space, the analysis of the time delays of signals is crucial to locating the sources of detected radiation. Because the correlation method requires the manipulation of awkward matrices to evaluate its accuracy, a solution is outlined based on minimizing the sum of the squares of signal deviations, and the algorithms for evaluating the resulting error are presented.
F.O.S.

N79-28912*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
DISSPLA PLOTTING ROUTINES FOR THE G189A EC/LS COMPUTER PROGRAM
J. E. Meza May 1979 13 p ref
(Contract NAS9-15800)
(NASA-CR-160284; LEC-13339; JSC-14925) Avail: NTIS HC A02/MF A01 CSCL 09B

Data from a G-189A execution is formatted and plotted. The plotting may be done at the time of execution of the program or stored on tape for processing at a later time. Author

N79-28913# Ohio State Univ., Columbus. Computer and Information Science Research Center.
A DOMAIN STRATEGY FOR COMPUTER PROGRAM TESTING Interim Report
Lee J. White, Edward I. Cohen, and B. Chandrasekaran Aug. 1978 77 p refs
(Grant AF-AFOSR-3416-77; AF Proj. 2304)
(AD-A067552; OSU-CISRC-TR-78-4; AFOSR-79-0444TR) Avail: NTIS HC A05/MF A01 CSCL 09/2

Computer programs contain two types of errors which have been identified as computations errors and domain errors. A domain error occurs when a specific input follows the wrong path due to an error in the control flow of the program. A path contains a computation error when a specific input follows the correct path, but an error in some assignment statement causes the wrong function to be computed for one or more of the output variables. A testing strategy has been designed to detect domain errors, and the conditions under which this strategy is reliable are given and characterized. A by-product of this domain strategy is a partial ability to detect computation errors.
Author (GRA)

N79-28914# California Univ., Los Angeles. Graduate School of Management.
ON THE USE OF PRODUCTIVITY AIDS IN SYSTEM DEVELOPMENT AND MAINTENANCE
Bennet P. Lientz and E. Burton Swanson 15 Jan. 1979 23 p refs
(Contract N00014-75-C-0266; NR Proj. 049-345)
(AD-A067947; TR-79-1) Avail: NTIS HC A02/MF A01 CSCL 09/2

There exists a substantial literature on productivity aids. Software aids have been developed in areas such as testing, documentation, programming, design, and analysis. A survey of almost five hundred organizations was performed to analyze various aspects of software maintenance. A purpose of the survey was to analyze the use of various productivity aids, and to ascertain relationships between their use and maintenance effort and characteristics. The survey indicates that no productivity aid was widely employed in system development and that many productivity aids do not address perceived problem areas. Areas perceived as problems include user involvement in the application, handling user enhancements, and management concerns with resource allocation. Statistical analysis found certain tools (HIPO), automated flowcharting, data base dictionaries, and test data generators more prevalent among organizations with larger data processing budgets. Use of HIPO (automated flowcharts) was found to be more prevalent among younger (older) applications. Data base dictionaries and test data generators were found to associate with larger systems. Analysis revealed that the impact of the use of tools on maintenance effort is dominated by characteristics of size, number of reports, system development experience, and use of data base management systems.
Author (GRA)

N79-28915# Arizona Univ., Tucson. Dept. of Chemistry.
ADVANCED SOFTWARE CONCEPTS FOR EMPLOYING MICROCOMPUTERS IN THE LABORATORY Interim Report
Scott B. Tilden and M. Bonner Denton Apr. 1979 26 p refs
(Contract N00014-75-C-0513)
(AD-A067892; TR-18) Avail: NTIS HC A03/MF A01 CSCL 09/2

Current trends in the computerization of specialized custom chemical instrumentation indicate the increasing utilization of dedicated microprocessors. Conventional software techniques often possess serious limitations in regard to initial development effort, execution speed, flexibility, and/or hardware required. A high-level interpretive compiler software package CONVERS is described which offers numerous advantages compared to conventional approaches including high speed operation, high level I/O, language flexibility, superior memory efficiency and a variety of other desirable characteristics. Author (GRA)

N79-28916# General Electric Co., Arlington, Va.
FACTORS AFFECTING PROGRAMMER PERFORMANCE IN A DEBUGGING TASK
Sylvia B. Sheppard, Phil Milliman, and Bill Curtis 19 Feb. 1979 66 p refs
(Contract N00014-77-C-0158; NR Proj. 197-037)
(AD-A068196; TR-79-388100-5) Avail: NTIS HC A04/MF A01 CSCL 09/2

This report is the third in a series investigating characteristics of software which are related to its psychological complexity. Three independent variables, length of program, complexity of control flow, and type of error, were evaluated for three different Fortran programs in a debugging task. Fifty-four experienced programmers were asked to locate a single bug in each of three programs. Documentation consisted of input files, correct output, and erroneous output. Performance was measured by the time to locate and successfully correct the bug. Small but significant differences in time to locate the bug were related to differences among programs and presentation order. Although there was no main effect for type of bug, there was a large program by error interaction suggesting the existence of context effects. Among measures of software complexity, Halstead's 'E' proved to be the best predictor of performance followed by McCabe's 'v(G)' and the number of lines of code. Number of programming languages known and familiarity with certain programming concepts also predicted performance. As in the previous experiments, experiential factors were better predictors for those participants with three or fewer years experience programming in FORTRAN. GRA

N79-28917# Delaware Univ., Newark. Dept. of Computer and Information Sciences.

TOWARD A LIBRARY OF FORMAL DESIGNS OF SOFTWARE Final Report

Ralph H. Weischedel and Linda Salsburg 1979 106 p refs (Grant AF-AFOSR-3539-78)

(AD-A068970; AFOSR-79-0528TR) Avail: NTIS HC A06/MF A01 CSCL 09/2

The most promising approach to problems of large software systems is the formal specification of module interfaces, during the design phase, based on the information-hiding principle. The advantages of formal specifications are as follows: (1) Their precision, lack of ambiguity, and attention to detail should cut down on design errors. (2) They provide informal verification of a hierarchically designed system while it is being designed. (3) Special design validation teams could rigorously verify a design before it is implemented, perhaps with the aid of automated tools for some of the verification. (4) Formal specification enables rigorous specification of the requirements that an embedded computer system must conform to. (5) They combine with the information-hiding principle to enable design of systems that are much easier to modify and maintain. This research has investigated the feasibility of a library of formal specifications so that designers could build on the work of others and thereby significantly cut the upfront effort involved. GRA

N79-28918# California Univ., Los Angeles. Graduate School of Management.

PROBLEM FACTORS AND DETERMINANTS IN APPLICATION SOFTWARE MAINTENANCE

Bennet P. Lientz and E. Burton Swanson Mar. 1979 24 p refs

(Contract N00014-75-C-0266)

(AD-A068968; Working-Paper-7-79) Avail: NTIS HC A02/MF A01 CSCL 09/2

The problems of application software maintenance in 487 data processing organizations were assessed in a survey. Factor analysis resulted in the identification of six problem factors: user knowledge, programmer effectiveness, product quality, programmer time availability, machine requirements, and system reliability. Of these, user knowledge accounted for about 60% of the total problem variance, providing new evidence of the importance of the user relationship, in accounting for system success or failure. Potential of determinants of the problems in maintenance were also analyzed. Problems of programmer effectiveness and product quality were seen to be relatively greater for systems which were older and larger, and where more relative effort in corrective maintenance was spent. All problem factors were positively associated with the level of effort in maintenance. A tendency toward lesser problems in maintenance existed, where the maintenance programmers were also involved in the development of the system. The problem of product quality was seen as lesser, where certain productivity techniques were used in development. Among various organizational controls, only the periodic audit seemed usefully related, by means of its association with lesser problems of user knowledge and product quality. GRA

N79-28919# George Washington Univ., Washington, D. C. School of Engineering and Applied Science.

DEVELOPMENT OF EXPERIMENTAL COMPILERS TO GENERATE EMULATORS FOR THE BMD DDP TEST BED FROM HIGH LEVEL LANGUAGE Final Report, Aug. 1978 - Mar. 1979

R. E. Merwin 1 Apr. 1979 122 p refs

(Contract DASG60-78-C-0115)

(AD-A068950) Avail: NTIS HC A06/MF A01 CSCL 09/2

The use of compilers to go from high level languages to microprograms is not commonplace. A few experimental compilers have been described but no support of this concept is provided by manufacturers of user microprogrammable computers. In this feasibility study two existing compilers accepting dialects of P1/1 were considered for generating microprograms for computers with a horizontally encoded control word format. One of the compilers which accepts the PLM language as input and produces quadruple intermediate text formats and DEC PDP 11 assembly language statements as outputs, was selected for modification to produce microprograms. A post processor is described which was added to this compiler to produce microcode for the DEC PDP 11/45 minicomputer. A performance analysis of this compiler concludes the report. GRA

N79-28920# Sharp (I.P.) Associates Ltd., Ottawa (Ontario).

EUCLID COMPILER FOR PDP-11 Quarterly Report, 1 Oct. - 31 Dec. 1978

David A. Bonyun 30 Jan. 1979 10 p

(Contract MDA903-78-C-0037; ARPA Order 3475)

(AD-A068542; IPSA-3B19-004; QR-4) Avail: NTIS HC A02/MF A01 CSCL 09/2

The full Euclid compiler will define a subset of Euclid between Small Euclid (the subset for bootstrapping) and Middle Euclid (the subset requested by the KSOS team). Complexities in this language, as defined, have appeared only during this writing of the compiler and some redefinition of the language seems indicated. GRA

N79-28921# Yale Univ., New Haven, Conn. Dept. of Computer Science.

MUTATION ANALYSIS

Timothy A. Budd (Calif. Univ., Berkeley), Richard J. Lipton (Calif. Univ., Berkeley), Richard A. DeMillo (Ga. Inst. of Technol., Atlanta), and Frederick G. Sayward Apr. 1979 31 p refs

(Contract N00014-75-C-0752; Grants DAAG29-78-G-0121; NSF MCS-78-07291)

(AD-A068118; RR-155) Avail: NTIS HC A03/MF A01 CSCL 09/2

A new type of software test is introduced, called mutation analysis. A method for applying mutation analysis is described, and the results of several experiments to determine its effectiveness are given. Finally it is shown how mutation analysis can subsume or augment many of the more traditional program testing techniques. GRA

N79-28922# Federal COBOL Compiler Testing Service, Washington, D. C.

FORTRAN COMPILER VALIDATION SUMMARY REPORT. DECSYSTEM 10: FORTRA, VERSION 5A

17 Apr. 1979 18 p 2 Vol.

(AD-A068158; FCCTS/FCVS66-VSR370) Avail: NTIS HC A02/MF A01 CSCL 09/2

This Validation Summary Report (VSR) for the DECSYSTEM - 10 FORTRAN Compiler Version 5A (TOPS-10 Version 6.03A) provides a consolidated summary of the results obtained from the validation of the subject compiler against the 1966 FORTRAN Standard (X3.9-1966). The VSR is made up of several sections showing the discrepancies found. These include an overview of the validation which lists all categories of discrepancies; a section relating the categories of discrepancies to the language; and a detailed listing of discrepancies together with the tests which were failed. GRA

N79-28923# Federal COBOL Compiler Testing Service, Washington, D. C.

FORTRAN COMPILER VALIDATION SUMMARY REPORT. DECSYSTEM 20: FORTRA, VERSION 5A

17 Apr. 1979 17 p

(AD-A068159; FCCTS/FCVS66-VSR375) Avail: NTIS HC A02/MF A01 CSCL 09/2

This Validation Summary Report (VSR) for the DECSYSTEM 20 FORTRAN Compiler Version 5A (TOPS-20 MONITOR Version 3A) provides a consolidated summary of the results obtained from the validation of the subject compiler against the 1966 FORTRAN Standard (X3.9-1966). The VSR is made up of several sections showing the discrepancies found. These include an overview of the validation which lists all categories of discrepancies; a section relating the categories of discrepancies to the language; and a detailed listing of discrepancies together with the tests which were failed. GRA

N79-28924# Stanford Univ., Calif. Systems Optimization Lab.

GLOBALLY CONVERGENT ALGORITHMS FOR CONVEX PROGRAMMING

Eric Rosenberg Feb. 1979 42 p refs

(Contract N00014-75-C-0267; Grants NSF MCS-76-81259; NSF MCS-76-20019)

(AD-A068492; SU-SOL-79-1) Avail: NTIS HC A03/MF A01 CSCL 12/2

We consider solving a (minimization) convex program by sequentially solving a (minimization) convex approximating subproblem and then executing a line search. Each subproblem is constructed from the current estimate of a solution of the given problem, possibly together with other information. Under mild conditions, solving the current subproblem generates a descent direction for an exact penalty function. Minimizing the exact penalty function along the current descent direction provides a new estimate of a solution, and a new subproblem is formed. For any arbitrary starting estimate, this scheme generates a sequence of estimates that converges to a solution of the given problem. Moreover, it is not necesssary to require that the functions defining the given problem and each subproblem be differentiable. GRA

N79-28925# Air Force Weapons Lab., Kirtland AFB, N. Mex.
SAIL, AN AUTOMATED APPROACH TO SOFTWARE DEVELOPMENT AND MANAGEMENT Final Report
Lewis P. Gaby, II, David C. Graham, and Clifford E. Rhoades, Jr. Jan. 1979 102 p refs
(AD-A068519; AD-E200258; AFWL-TR-78-80) Avail: NTIS HC A06/MF A01 CSCL 09/2

SAIL is a software development and management aid which provides a basis for disciplined design, programming, maintenance, and execution of computer programs. The system achieves a new level of centralized software development and maintenance control, while simultaneously decentralizing applications, providing controlled task specialization at compile time, and realizing portability between dissimilar machines. The system encourages economy by reducing duplication of effort often found when many versions of a basic source code are required. The system achieves efficient hardware utilization by providing source code which is specialized at execution time for the task. Except for a few machine dependent statements, SAIL is written in ANSI (66) FORTRAN IV. The system is currently operating on CDC, IBM, and Honeywell computers. GRA

N79-28926# General Electric Co., Sunnyvale, Calif. Command and Information Systems.
SOFTWARE DATA BASELINE ANALYSIS Final Technical Report, 14 Nov. 1977 - 17 Nov. 1978
D. L. Fish and M. T. Matsumoto Mar. 1979 84 p refs
(Contract F30602-78-C-0022; AF Proj. 5581)
(AD-A068533; RADC-TR-79-67) Avail: NTIS HC A05/MF A01 CSCL 09/2

The subject report summarizes the results of an analysis of software error data supplied by the Information Sciences Division of Rome Air Development Center (RADC). These data consisted of the software problem histories of five large-scale software developments, individually collected by the development contractors and supplied to RADC. The problems were classified by a previously developed error typology. The purpose of the analysis was to investigate the existence of any consistencies in the occurrence of errors utilizing the five development efforts. The analysis included consideration of the error typology, rate of occurrence, time of occurrence, time to fix, and module size. Results of the analysis isolate methodological problems in the gathering of software error data and suggest that positive incentives be provided to development team members involved in the data collection effort. GRA

N79-28927# Wisconsin Univ. - Madison. Mathematics Research Center.
A NOTE ON ENUMERATING BINARY TREES Technical Summary Report
Marvin Solomon and Raphael A. Finkel Feb. 1979 13 p refs
(Contract DAAG29-75-C-0024)
(AD-A068900; MRC-TSR-1926) Avail: NTIS HC A02/MF A01 CSCL 12/1

Algorithms have been presented for computing a bijection between the set of binary trees on n nodes and an initial segment of the positive integers. A more complicated algorithm was also presented that computes a different bijection, claiming that their algorithm is more efficient and has advantages if a sequence of several consecutive trees is required. A modification of the first algorithm is presented that is simpler than the first and as efficient as the second. Also given is a new linear-time algorithm for transforming a tree into its successor in the natural ordering of binary trees. GRA

N79-28928# Federal COBOL Compiler Testing Service, Washington, D. C.
COBOL COMPILER VALIDATION SUMMARY REPORT: DATA GENERAL C350 - AOS COBOL
30 Apr. 1979 40 p
(AD-A068919; FCCTS/CCVS74-VSR360) Avail: NTIS HC A03/MF A01 CSCL 09/2

This Validation Summary Report (VSR) for the Data General AOS COBOL Compiler Version 2.00 (AOS Version 2.03) provides a consolidated summary of the results obtained from the validation of the subject compiler against the 1974 COBOL Standard (X3.23-1974/FIPS PUB 21-1). The compiler was validated at the low level of FIPS PUB 21-1. The VSR is made up of several sections showing the discrepancies found. These include an overview of the validation which lists all categories of discrepancies by level/module within X3.23-1974, a section relating the categories of discrepancies to each of the Federal levels of the language; and a detailed listing of discrepancies together with the tests which were failed. GRA

N79-28929# Maryland Univ., College Park. Computer Science Center.
STATISTICAL INFERENCE THEORY APPLIED TO IMAGE MODELING
Ramalingam Chellappa and Narendra Ahuja Mar. 1979 49 p refs
(Grant AF-AFOSR-3271-77)
(AD-A068745; CSC-TR-745) Avail: NTIS HC A03/MF A01 CSCL 09/2

This paper considers the application of system identification techniques using spectral representation for fitting models to textures and images and consists of two parts. In part I, we develop consistent decision rules for choosing the neighborhood in a one-dimensional autoregressive (AR) model. In part II, the theory is extended to the case of stationary two-dimensional random fields. GRA

N79-28930# Stanford Univ., Calif. Dept. of Computer Science.
THE ERRATA OF COMPUTER PROGRAMMING
Donald E. Knuth Jan. 1979 59 p
(Contract N00014-76-C-0330; Grant NSF MCS-77-23738)
(AD-A068393; STAN-CS-97-712) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report lists all corrections and changes of Volumes 1 and 3 of The Art of Computer Programming, as of January 5, 1979. This updates the previous list in report CS551, May 1976. The second edition of Volume 2 has been delayed two years due to the fact that it was completely revised and put into the TEX typesetting language; since publication of this new edition is not far off, no changes to Volume 2 are listed here. GRA

N79-28931# Argonne National Lab., Ill.
PERFORMANCE PROFILES AND SOFTWARE EVALUATION
J. N. Lyness 1978 12 p Presented at the Performance Evaluation of Numerical Software (IFIP), Baden, Austria, 10-15 Dec. 1978
(Contract W-31-109-eng-38)
(CONF-781233-1) Avail: NTIS HC A02/MF A01

The problem of comparing and evaluating different items of numerical software that carry out identifical tasks and require input of an identical or very similar nature nature is considered. The results of such work are often very extensive. Recommendations are made concerning the sort of numerical measurements to be made in such experiments. Precision-bound and heuristic-bound numerical routines are introduced, and their performance profiles are described. Various basic principles in the design of numerical experiments for the evaluation of heuristic-bound routines are outlined. Following these principles leads to a testing procedure that produces results that are significantly easier to evaluate than some of those traditionally used. The underlying principles are general and applicable in many areas of numerical software evaluation. DOE

N79-28932# Sandia Labs., Livermore, Calif.
USER'S GUIDE FOR MIRVAL: A COMPUTER CODE FOR COMPARING DESIGNS OF HELIOSTAT-RECEIVER OPTICS FOR CENTRAL RECEIVER SOLAR POWER PLANTS
P. L. Leary and J. D. Hankins Feb. 1979 128 p refs
(Contract EY-76-C-04-0789)
(SAND-77-8280) Avail: NTIS HC A07/MF A01

MIRVAL is a Monte Carlo program which simulates the heliostats and a portion of the receiver for solar energy central receiver power plants. Models for three receiver types and four kinds of heliostats are included in the code. The three receiver types modeled are an external cylinder, a cylindrical cavity with a downward-facing aperature, and a north-facing cavity. Three heliostats which track in elevation and azimuth are modeled, one of which is enclosed in a plastic dome. The fourth type consists of a rack of louvered reflective panels with the rack rotatable about a fixed horizontal axis. Phenomena whose effects are simulated are shadowing, blocking, mirror tracking, random errors in tracking and in the conformation of the reflective surface, optical figure of the reflective surface, insolation, angular distribution of incoming sun rays to account for limb darkening and scattering, attenuation of light between the mirrors and the receiver, reflectivity of the mirror surface, and mirror aiming strategy. DOE

N79-28933# Sandia Labs., Albuquerque, N. Mex.
SKTWO: A TWO-DIMENSIONAL LAGRANGEAN WAVE-CODE WITH SHOCK FITTING
D. L. Hicks and M. M. Madsen Mar. 1979 44 p refs
(Contract EY-76-C-04-0789)
(SAND-78-1806) Avail: NTIS HC A03/MF A01

SKTWO is a 2-D Lagrangean wavecode with the following features included: operator splitting to reduce 2-D calculations to 1-D calculations, a shock fitting scheme called the SK2 algorithm to provide sharper solutions at shock fronts, and a method called the Tangled Grid-Free calculational procedure to provide for continuing the Lagrangean calculation despite apparent grid entanglement due to large distortions. DOE

62 COMPUTER SYSTEMS

Includes computer networks.

N79-28934 George Washington Univ., Washington, D. C.
MODELING AND PERFORMANCE EVALUATION OF MULTI-PROGRAMMED, TIME-CRITICAL COMPUTER SYSTEMS Ph.D. Thesis
Dave Eliase Eckhardt 1979 154 p
Avail: Univ. Microfilms Order No. 7915837

Recently, validation studies have established the utility and accuracy of queueing models for multiprogrammed systems. The applicability of these models to multiprogrammed systems which operate in the environment of time-critical activity are described. The problem presented is that the deterministic nature of the time-critical process violates the Poisson assumptions of preemptive-priority queueing models. The central processor service distribution function for background tasks in this time-critical environment is developed. An approximate processor-shared model is presented which allows an immediate application of state-of-the-art queueing models. A measure of the validity of this model is the magnitude of the average batch service rate divided by the time-critical interrupt rate. Based on this measure, the range of applicability of this model is examined. Dissert. Abstr.

N79-28935 California Univ., Los Angeles.
DESIGN AND VERIFICATION OF DISTRIBUTED INTERACTING PROCESSES Ph.D. Thesis
Dono Van-Mierop 1979 159 p
Avail: Univ. Microfilms Order No. 7915686

A design methodology for reliable distributed systems is developed integrating design and verification procedures. The methodology is restricted to a class of systems called Distributed Interacting Processes (DIPs) which covers a variety of important system application areas such as communication networks, distributed data bases, multimicroprocessors, CPUs interacting with their peripherals, redundant computer systems, and more. The input to integrated design and verification procedure is a customer's specification of a system (often called the requirements) and a designer's proposed implementation, i.e. a high level model of a system whose realization satisfies the requirements. A verification procedure determines the consistency between the implementation and the specification, and a realization procedure generates a hardware/software description which preserves the behavior of the high level model. The elements of the design methodology developed for DIPs include: a modeling language, a realization procedure, a specification technique, and a verification technique. Dissert. Abstr.

N79-28936 California Univ., Berkeley.
PRACTICAL COMPILER IMPLEMENTATION ON SMALL COMPUTER SYSTEMS Ph.D. Thesis
Olivier Martin Roubine 1978 204 p
Avail: Univ. Microfilms Order No. 7914750

Techniques for reducing the main memory requirements of compilers are studied in the context of microprocessor-based computer systems. Various known methods for reducing the size of table-driven parsers are compared. Techniques for achieving a tighter compression with precedence parsers, with only a small degradation of the error detection are discussed. It is shown that the productions of a grammar are used during a compilation in certain patterns that are reminiscent of the phenomenon of locality in program behavior. A variety of techniques similar to demand paging are developed for the automatic replacement of semantic routines, and the underlying grammatical and linguistic structures are exploited to improve the efficiency of the method. This method is applied to a previously existing compiler and yields a forty-three percent reduction in the size of the code segment, with an acceptable speed degradation. Dissert. Abstr.

N79-28937 California Univ., Berkeley.
A SYSTEMATIC DESIGN AND ANALYSIS OF RECONFIGURABLE DISTRIBUTED COMPUTER SYSTEMS Ph.D. Thesis
Tanuku Krishnarao 1978 260 p
Avail: Univ. Microfilms Order No. 7914663

The design of reconfigurable distributed computer systems to increase their reliability, availability, and survivability is presented. The issue of reconfigurability of a distributed system to cope with different types of failures was examined. Specific results obtained include: (1) characterization of distributed computer systems; (2) classification of failures; (3) a design methodology to design reconfigurable systems; (4) feasibility of reconfiguration; (5) synthesis and selection of a reconfiguration strategy; and (6) the design of an example systems to demonstrate the applicability of the concepts. Dissert. Abstr.

63 CYBERNETICS

Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

N79-28938 Yale Univ., New Haven, Conn.
ADAPTIVE CONTROL OF SINGLE-INPUT, SINGLE-OUTPUT LINEAR SYSTEMS Ph.D. Thesis
Arie Feuer 1978 137 p
Avail: Univ. Microfilms Order No. 7916612

The problem of developing a methodology for designing a parameter adaptive control system for a single input, single output process is discussed. A procedure is presented for designing such controllers. It is shown by analytical proof that, under relatively mild assumptions, these controllers result in globally stable adaptive control systems. Dissert. Abstr.

N79-28939 Yale Univ., New Haven, Conn.
STABLE ADAPTIVE CONTROL Ph.D. Thesis
Lena S. Valavani 1978 168 p
Avail: Univ. Microfilms Order No. 7916529

Two different methods - direct and indirect control - are presented in a unified manner. In direct control, otherwise known as model reference adaptive control, the behavior desired of the system (plant) is prescribed by a model, and the controller

parameters are dynamically adjusted directly using suitable algorithms (adaptive laws) which are based essentially on the error between plant and model responses. In indirect control the plant parameters are identified and their estimates, in turn, are used in the adjustment of the controller parameters. Extensive simulation studies carried out on the digital computer, including control for unstable plants, demonstrate the efficiency of the schemes suggested, their insensitivity to structural perturbations and, hence, the possibility of using them in real applications.
Dissert. Abstr.

N79-28940 Connecticut Univ., Storrs.
ON THE APPLICATION OF INTERACTIVE GRAPHICS TO THE COMPUTER-AIDED DESIGN OF CONTROL SYSTEMS Ph.D. Thesis
John Arthur Hammer 1979 201 p
Avail: Univ. Microfilms Order No. 7914157

The design of computer aided design (CAD) systems in general and a CACSD system in particular are presented. A detailed discussion of the problems inherent in the design of CAD systems, and some recommended solutions are presented. The particular areas covered are: (1) top-down versus bottom-up approach to system design; (2) modularity and machine independence; (3) data structures; (4) conversational interaction; (5) graphic display; and (6) graphic interaction. Thoughts concerning the structured approach to software development and a users manual for the CACSD system developed are presented. The results of tests performed on the system are presented. Dissert. Abstr.

N79-28941 Purdue Univ., Lafayette, Ind.
THE FATIGUE EXTRACTION PROBLEM FOR STATISTICAL PATTERN RECOGNITION Ph.D. Thesis
Robert Dunham Short, III 1978 111 p
Avail: Univ. Microfilms Order No. 7914973

Finding the optimal nonlinear features for a criterion function depending upon the first- and second-order class conditional moments is considered. The optimal solution is found to be a parametric function of the conditional density functions. By imposing a further restriction on the functional dependence of the conditional moments the optimal mapping takes on an intuitively pleasing function of the posterior probabilities. Given a finite number of features the problem of finding the best linear mapping to a subspace is studied. The resulting optimum mapping is a linear combination of the projections of the posterior probabilities onto the subspace spanned by the original features. The problem of finding the best single feature and sequential feature selection is discussed. Dissert. Abstr.

N79-28942 Illinois Univ. at Urbana-Champaign.
MODEL REDUCTION AND DECENTRALIZED CONTROL OF LARGE SCALE SYSTEMS USING CHAINED AGGREGATION Ph.D. Thesis
Edwin Chi-Yu Tse 1978 253 p
Avail: Univ. Microfilms Order No. 7913643

The model reduction of linear time invariant systems and the synthesis of decentralized control with parallel computations by utilizing the given systems information structure, e.g., structural and output information is presented. The chained aggregation procedure which leads to the generalized Hessenberg system representation (GHR) was developed. The structural features of the GHR were studied. The influences of the Hessenberg blocks on trajectory and eigenvalue perturbation were examined. The generalized QL (GQL) and the restricted QL (RQL) algorithms to be used in conjunction with the GHR for construction of reduced order models were designed. The GHR is shown to exhibit a class of plausible reduced order models suitable for further parameter adjustment if necessary. The GHR structure is used for the synthesis of decentralized control in the tracking of reference interconnection variables in an interconnected large scale system. Dissert. Abstr.

N79-28943 California Univ., Berkeley.
CONTRIBUTIONS TO FEEDBACK THEORY FOR NONLINEAR SYSTEMS: FEEDBACK FUNDAMENTALS AND THE SERVOMECHANISM PROBLEM Ph.D. Thesis
Yung-Terng Wang 1978 180 p
Avail: Univ. Microfilms Order No. 7914805

The foundations of feedback theory for nonlinear, time-varying, multi-input, multi-output, distributed systems were studied. The classical Black formula for the nonlinear case is discussed. The achievable benefits and limitations of feedback in desensitization, disturbance attenuation, linearizing, asymptotic tracking and disturbance rejection, and stabilization for nonlinear systems are presented. The use of feedback in achieving robust asymptotic tracking and disturbance rejection (the robust servomechanism problem) is explored. The limitations and tradeoffs of feedback, imposed by the stability requirement, the feedback structure, etc., in desensitization and disturbance attenuation were examined. Results clarify the features of nonlinear systems which are required for feedback to be advantageous and thus shall help engineers obtain better understanding of nonlinear feedback systems.
Dissert. Abstr.

N79-28944# United Technologies Research Center, East Hartford, Conn.
MICROPROCESSOR REQUIREMENTS FOR IMPLEMENTING MODERN CONTROL LOGIC Final Report, 1 Feb. 1978 - 31 Jan. 1979
Florence A. Farrar and Richard S. Eidens Mar. 1979 77 p refs Presented at Soc. of Automotive Engr. Aerospace Control and Guidance Systems Comm. Meeting, Cambridge, Mass., 28 Sep. 1978
(Contract F49620-78-C-0017; AF Proj. 2304)
(AD-A067551; UTRC/R79-944258-2; AFOSR-79-0449TR)
Avail: NTIS HC A05/MF A01 CSCL 09/2

Analytical procedures for establishing microprocessor requirements for multivariable feedback control of linear stochastic dynamic systems were developed and evaluated. Key issues in microprocessor implementation of modern estimation and control logic include (1) accuracy, (2) computational capability including arithmetic as well as interface speed, and (3) memory requirements. Compatibility of current microprocessor technology with the established implementation requirements was assessed. The analytical method to establish microprocessor accuracy requirements for closed-loop digital control of linear stochastic systems is based upon defining a quadratic performance index that provides a quantitative measure of performance degradation. This method is employed to determine closed-loop system time response sensitivity to (1) microprocessor word length and (2) system structure (standard, Jordan canonical or companion forms) within the control logic. The developed procedures were evaluated and illustrated by application to (1) a second-order system and (2) a linearized fifth-order F100 turbofan engine model. Results were verified using a digital simulation of a continuous system/microprocessor controller. Microprocessors considered were the Intel 8080 microprocessor (an 8 bit microprocessor) and the Digital Equipment Corporation (DEC) LSI 11/2 microprocessor (a 16 bit microprocessor). GRA

N79-28945# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
PROGRESS IN ARTIFICIAL INTELLIGENCE 1978, VOLUME 1
Patrick H. Winston and Richard H. Brown 1979 455 p refs 2 Vol.
(Contracts N00014-75-C-0643; N00014-77-C-0389)
(AD-A068838) Avail: NTIS HC A20/MF A01 CSCL 06/4

This two volume collection was assembled to introduce advanced topics in Artificial Intelligence and to characterize the MIT point of view. With this in mind, the selected contributions are meant to be representative of either the research area explored or the methodology employed. Some of the shorter selections appear in full in order to convey a feeling for the detail and precision required in implementing working programs. Usually, however, length considerations have forced considerable abridgment. This necessarily means that the sections often describe what can be done but not much about how. With one exception, all of the sections originally appeared as publications of the MIT Artificial Intelligence Laboratory. Volume I includes reports on the general topics of: Expert Problem Solving: Natural Language Understanding and Intelligent Computer Coaches; and Representation and Learning. GRA

N79-28946# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
PROGRESS IN ARTIFICIAL INTELLIGENCE 1978, VOLUME 2

Patrick H. Winston and Richard H. Brown 1979 456 p refs 2 Vol.
(Contracts N00014-75-C-0643; N00014-77-C-0389)
(AD-A068839) Avail: NTIS HC A20/MF A01 CSCL 06/4

The major topics treated in Volume II are: Understanding Vision; Manipulation and Productivity Technology; and Computer Design and Symbol Manipulation. GRA

N79-28947# Purdue Univ., Lafayette, Ind. Dept. of Mathematics.
A PROPOSAL FOR RESEARCH ON STOCHASTIC METHODS AND PROBLEMS IN APPLIED MATHEMATICS Final Report
Charles J. Holland 1979 17 p refs
(Grant AF-AFOSR-3286-77; AF Proj. 2304)
(AD-A068913; AFOSR-79-0603TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The determination of the limiting long time behavior of the system using a fixed control was answered in the case of a stochastic system perturbed by a small additive noise term where the control is such that the corresponding determinstic system possesses a stable limit cycle. A new characterization was given of the principal eigenvalue for second-order linear elliptic partial differential equations, not necessarily self-adjoint, with both natural and Dirichlet boundary conditions. A new alternative numerical method was given for calculating both the principal eigenvalue and corresponding eigenvector in the case of natural boundary conditions. GRA

N79-28948# Sandia Labs., Albuquerque, N. Mex.
COMPUTERIZED LCC/ORLA METHODOLOGY
J. T. Henderson 1979 15 p Presented at the Ann. Reliability and Maintainability Symp., Washington, D. C., 23 Jan. 1979
(Contract EY-76-C-04-0789)
(SAND-78-0706C; Conf-790116-2) Avail: NTIS HC A02/MF A01

The effort in developing CDC 6600 computer programs for Optimum Repair Level Analysis (ORLA) and Life Cycle Cost (LCC) analysis is described. The three repair level strategies referenced in AFLCM/AFSCM 800-4 (base discard of subassemblies, base repair of subassemblies, and depot repair of subassemblies) was expanded to include an additional three repair-level strategies (base discard of complete assemblies and, upon shipment of complete assemblies to the depot, depot repair of assemblies by subassembly repair, and depot repair of assemblies by subassembly discard). The expanded ORLA was used directly in an LCC model that was procedurally altered to accommodate the ORLA input data. Available from the LCC computer run was an LCC value corresponding to the strategy chosen from the ORLA. DOE

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N79-28949 Illinois Univ. at Urbana-Champaign.
NUMERICAL INTEGRATION OF DIFFERENTIAL EQUATIONS OCCURRING IN TWO-POINT BOUNDARY VALUE PROBLEMS Ph.D. Thesis
Rodger Bruce Jackson 1979 143 p
Avail: Univ. Microfilms Order No. 7915367

An accurate procedure is decribed for numerically solving two-point boundary value problems which contain growing solutions. The procedure involves the process of reducing the order of a differential equation when one solution is known. Two applications of the procedure are given, a fourth order differential equation with two growing solutions and a system of eighth order differential equations of motion for a hemispherical shell. In both examples before the procedure is started, the equations are rewritten as a system of first order differential equations. When solving two-point boundary value problems by the reduction of order method, first order equations were generally easier to work with than higher order differential equations. For both applications a computer program was developed to solve the system of differential equations. Dissert. Abstr.

N79-28950*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FLUX VECTOR SPLITTING OF THE INVISCID EQUATIONS WITH APPLICATION TO FINITE DIFFERENCE METHODS
Joseph L. Steger and R. F. Warming Jul. 1979 54 p refs
(NASA-TM-78605; A-7893) Avail: NTIS HC A04/MF A01 CSCL 12A

The conservation-law form of the inviscid gasdynamic equations has the remarkable property that the nonlinear flux vectors are homogeneous functions of degree one. This property readily permits the splitting of flux vectors into subvectors by similarity transformations so that each subvector has associated with it a specified eigenvalue spectrum. As a consequence of flux vector splitting, new explicit and implicit dissipative finite-difference schemes are developed for first-order hyperbolic systems of equations. Appropriate one-sided spatial differences for each split flux vector are used throughout the computational field even if the flow is locally subsonic. The results of some preliminary numerical computations are included. Author

N79-28951*# Myers (Raymond H.), Blacksburg, Va.
THE ALTERATION OF PROFILE ANALYSIS TO ACCOMMODATE TESTING FUNCTIONS
Raymond H. Myers Jul. 1979 89 p refs
(NASA Order L-72497-A)
(NASA-CR-159117) Avail: NTIS HC A05/MF A01 CSCL 12A

The development of a methodology was studied for testing differences among several pilot functions, where the data points represent averages at various frequencies. Topics discussed include: basic assumptions, hypothesis, profile analysis, alteration of profile analysis to accommodate testing functions, test and procedures, and power of tests. F.O.S.

N79-28952# Nagoya Univ. (Japan). Inst. of Plasma Physics.
NEW INTEGRABLE NONLINEAR EVOLUTION EQUATIONS
M. Wadati (Tsukuba Univ.), K. Konno (Nihon Univ.), and Y. H. Ichikawa May 1979 11 p refs
(IPPJ-394) Avail: NTIS HC A02/MF A01

A new series of integrable nonlinear evolution equations is presented. The equations are novel in the sense that the nonlinear terms have saturation effects. It is shown that the equations have an infinite number of conservation laws and can be expressed in the Hamiltonian form. Author

N79-28953*# National Aeronautics and Space Administration, Washington, D. C.
TASK FORCE ON APPLIED MATHEMATICS
Angelica Prieto Jul. 1979 25 p Transl. into ENGLISH from Cienc. Desarrollo (Mexico), no. 26, May - Jun. 1979 p 7-9 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75657) Avail: NTIS HC A02/MF A01 CSCL 12A

Tomas Garza relates how the Research Center for Applied Mathematics Systems and Services in Mexico became the Research Institute for Applied Mathematics and Systems and what the type of work performed is. M.M.M.

N79-28954# Texas A&M Univ., College Station. Inst. of Statistics.
TIME SERIES MODELING, SPECTRAL ANALYSIS, AND FORECASTING
Emanuel Parzen Mar. 1979 26 p refs
(Contract N00014-78-C-0599)
(AD-A067773; TR-N-7) Avail: NTIS HC A03/MF A01 CSCL 12/1

A strategy for building models for an observed time series is presented in this paper. We seek to fit time domain models which can be interpreted in terms of trend and seasonal components, provide forecasts, and provide spectral estimators. Our time series modeling strategy attempts to achieve distribution function. The approach described could be called: the autoregressive spectral method for time domain model identification of

non-stationary time series (which could be abbreviated AR-SPECTRAL-TIME-ID). Author (GRA)

N79-28955# Rome Air Development Center, Griffiss AFB, N.Y.
HILBERT TRANSFORM BY NUMERICAL INTEGRATION
I. J. Weinberg Jan. 1979 20 p refs
(AD-A068084; RADC-TR-79-3) Avail: NTIS
HC A02/MF A01 CSCL 12/1

Many engineering studies require the evaluation of a Hilbert Transform of a tabular function. The function is also considered as an even function in order to conform to physical reality. A numerical procedure, incorporated into a FORTRAN subroutine HTRAN, has been developed to accomplish this task. The procedure has been designed to avoid the theoretical and numerical singularities and employs cubic polynomial interpolation to enhance numerical accuracy. GRA

N79-28956# Wisconsin Univ. - Madison. Mathematics Research Center.
SPLINE APPROXIMATION TO THE SOLUTION OF A CLASS OF ABEL INTEGRAL EQUATIONS
Hing-Sum Hung Mar. 1979 26 p refs
(Contract DAAG29-75-C-0024)
(AD-A068944; MRC-TSR-1933) Avail: NTIS
HC A03/MF A01 CSCL 12/1

Global approximation methods for solving the Abel integral equation by means of splines with full continuity are considered. The methods are based on using the differentiated form of the above equation. It is shown that the use of linear splines in C leads to a 2-alpha method for 0 - alpha - 1 and the use of quadratic splines in C1 leads to a 3-alpha method, which computational experiments indicate is stable for 0 - alpha - 1. The same technique applied to cubic and higher-order splines gives rise to divergent methods. GRA

N79-28957# Wisconsin Univ. - Madison. Mathematics Research Center.
CONVEX SPECTRAL FUNCTIONS
Shmuel Friedland Mar. 1979 26 p refs
(Contract DAAG29-75-C-0024)
(AD-A068942; MRC-TSR-1931) Avail: NTIS
HC A03/MF A01 CSCL 12/1

In this paper we characterize all convex functionals defined on certain convex sets of hermitian matrices and which depend only on the eigenvalues of matrices. We extend these results to certain classes of non-negative matrices. This is done by formulating some new characterizations for the spectral radius of non-negative matrices, which are of independent interest. GRA

N79-28958# Stanford Univ., Calif. Dept. of Operations Research.
OBSERVATIONS ON A CLASS OF NASTY LINEAR COMPLEMENTARITY PROBLEMS
Richard W. Cottle Dec. 1978 49 p refs
(Contract N00014-75-C-0267; Grant NSF MCS-76-81259)
(AD-A068472; SU-TR-78-34) Avail: NTIS HC A03/MF A01
CSCL 12/1

Earlier papers by Murty (16) and Fathi (7) have exhibited classes of linear complementarity problems for which the computational effort (number of pivot steps) required to solve them by Lemke's algorithm (13) or Murty's algorithm (15) grows exponentially with the problem size (number of variables). In this paper we consider the sequences of complementary bases that arise as these problems are solved by the aforementioned algorithms. There is a natural correspondence between these bases and binary n-vectors through which the basis sequences can be identified with particular Hamiltonian paths on the unit n-cube and with the binary Gray code representations of the integers from 0 to 2 to the n minus 1. GRA

N79-28959# Brown Univ., Providence, R. I. Dept. of Applied Mathematics.
A ROBUST DISCRETE STATE APPROXIMATION TO THE OPTIMAL NONLINEAR FILTER FOR A DIFFUSION Interim Report
Harold J. Kushner Mar. 1979 17 p refs
(Contract N00014-76-C-0279; Grants AF-AFOSR-3063-76; NSF MCS-76-07247)
(AD-A068995; AFOSR-79-0520TR) Avail: NTIS
HC A02/MF A01 CSCL 12/1

A robust computable approximation to the nonlinear filtering problem for a diffusion model is treated. GRA

N79-28960# Brown Univ., Providence, R. I. Div. of Applied Mathematics.
HOPF BIFURCATION FOR FUNCTIONAL EQUATIONS Interim Report
Jack K. Hale and Jose Carlos F. deOliveira (Sao Paulo Univ.) Jan. 1979 36 p refs
(Grants AF-AFOSR-3092-77; DAAG27-76-G-0294; NSF MCS-76-07246)
(AD-A068994; AFOSR-79-0602TR) Avail: NTIS
HC A03/MF A01 CSCL 12/1

The purpose of this paper is to study the existence of a smooth Hopf bifurcation for functional equations. The bifurcation parameters may include the delays. Results will be described for a special case of equations considered. Author (GRA)

N79-28961# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
PARTITIONED TRANSIENT ANALYSIS PROCEDURES FOR COUPLED-FIELD PROBLEMS
K. C. Park Feb. 1979 39 p refs Presented at Intern. Conf. on Computational Methods in Nonlinear Mechanics, Austin, Tex., 25-30 Mar. 1979
(Contracts N00014-74-C-0355; DNA001-78-C-0026)
(AD-A068621; LMSC-D633955) Avail: NTIS
HC A03/MF A01 CSCL 12/1

A general partitioned transient analysis procedure is proposed, which is amenable to a unified stability analysis technique. The procedure embodies two existing inplicit-explicit procedures and one existing implicit-implicit procedure. A new implicit-explicit procedure is discovered, as a special case of the general procedure, that allows degree-by-degree implicit or explicit selections of the solution vector and can be implemented within the framework of the implicit integration packages. A new element-by-element implicit-implicit procedure is also presented which satisfies program modularity requirements and enables the use of single-field implicit integration packages to solve coupled-field problems. GRA

N79-28962# Wisconsin Univ. - Madison. Mathematics Research Center.
A HIGHER ORDER GLOBAL APPROXIMATION METHOD FOR SOLVING AN ABEL INTEGRAL EQUATION BY QUADRATIC SPLINES
Hing-sum Hung Feb. 1979 26 p refs
(Contract DAAG29-75-C-0024)
(AD-A068904; MRC-TSR-1921) Avail: NTIS
HC A03/MF A01 CSCL 12/1

In the present paper, a global approximation method is developed for obtaining higher accuracy results involving higher order splines with full continuity. The quadratic spline case is investigated in detail. The technique is to differentiate the original equation, and solve the differentiated equation by using a quadratic spline in C(1). The computational effort required is only marginally greater than that required for a linear spline solution of the original equation. Convergence is obtained not only for the approximate solution but also for its first two derivatives at each point in the interval of integration. GRA

N79-28963# Wisconsin Univ. - Madison. Mathematics Research Center.
SPLINE FUNCTIONS ON THE CIRCLE: CARDINAL L-SPLINES REVISITED
Charles A. Micchelli and A. Sharma Feb. 1979 22 p refs
(Contract DAAG29-75-C-0024)
(AD-A068901; MRC-TSR-1918) Avail: NTIS
HC A02/MF A01 CSCL 12/1

In this paper we extend known results on cardinal L-spline interpolation to include piecewise solutions of any real constant coefficient differential operator. We apply our results to spline interpolation on the circle and thus unify and extend earlier work on this problem. GRA

N79-28964# Los Alamos Scientific Lab., N. Mex.
ANALYSIS OF ERROR IN MONTE CARLO TRANSPORT CALCULATIONS
Thomas Edward Booth Jan. 1979 118 p refs
(Contract W-7405-eng-36)
(LA-7636-T) Avail: NTIS HC A06/MF A01

Integral equations were derived that, when solved, predicted errors in Monte Carlo calculations in nonmultiplying media. Error predictions are allowed in nonanalog Monte Carlo calculations of multiplying systems, even when supercritical. Nonanalog techniques such as biased kernels, particle splitting, and Russian Roulette are incorporated. Equations are presented which allow prediction of how much a specific variance reduction technique reduces the number of histories required, to be weighed against the change in time required for calculation of each history. DOE

N79-28965# Argonne National Lab., Ill. Applied Physics Div.
MONTE CARLO COMPUTATION OF DIRECTIONAL DIFFUSION COEFFICIENTS
E. M. Gelbard and R. Pego 10 Jan. 1979 13 p refs Presented at Conf. on Computational Methods in Nucl., Eng., Williamsburg, Va., 23 Apr. 1979
(Contract W-31-109-eng-38)
(FRA-TM-117; Conf-790402-3) Avail: NTIS HC A02/MF A01

In earlier work the net leakage from lattice cells was computed, from first principles, by Monte Carlo. On the other hand, this leakage was divided into axial and radial components by an ad hoc prescription. It has recently been found that this prescription leads, in some cases, to anomalous results. A more rigorous computation of leakage components is formulated. Calculations using the proposed method have been carried out for some typical GCFR lattice cells. These computations give an axial heterogeneity effect about twice as large as the radial effect, thus tending to substantiate a working hypothesis advanced earlier on the basis of simple physical arguments. DOE

N79-28966# California Univ., Livermore. Lawrence Livermore Lab.
BLEND: CUBIC SPLINE BLENDING ROUTINE
R. P. Dickinson, Jr. (Chabot College, Livermore, Calif.) and R. E. Carlson (Grove City College, Pa.) Feb. 1979 27 p refs
(Contract W-7405-eng-48)
(UCID-18088) Avail: NTIS HC A03/MF A01

BLEND is a bivariate surface fitting routine which approximates smooth surfaces to a very high degree of accuracy. The techniques originate from Dr. William Gordon of General Motors Research Laboratories. The techniques are described, and an implementation specialized to cubic spline blending is presented. A numerical example is given. DOE

N79-28967# Washington Univ., Seattle. Dept. of Genetics.
MATHEMATICALLY TRACTABLE FAMILY OF GENETIC MAPPING FUNCTIONS WITH DIFFERENT AMOUNTS OF INTERFERENCE
Joseph Felsenstein 1978 12 p refs
(Contract EY-76-S-06-2225-005)
(RLO/2225/T5-47) Avail: NTIS HC A02/MF A01

By extension of the argument of Kosambi, a family of mapping functions is derived, which have a parameter regulating the intensity of interference. Different values of this parameter yield the Haldane and Kosambi mapping functions as special cases. The parameter is the coincidence coefficient for nearby small intervals. The family included mapping functions for negative interference. A simple rule for combining recombination fractions in adjacent intervals is obtained. DOE

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N79-28968 California Univ., Berkeley.
GRAPHICAL COMPARISONS OF POPULATIONS IN SOME NON-LINEAR MODELS Ph.D. Thesis
Vijayan Narayana Nair 1978 87 p
Avail: Univ. Microfilms Order No. 7914710

Several populations are compared in terms of shift functions which measure how much the variables from one population must be shifted to be aligned in distribution with variables from another. Estimation and simultaneous confidence procedures for the shift function are obtained in general models both for situations with and without reference populations. The various procedures are compared in terms of pointwise and global efficiency criteria. The results are extended to randomly censored models via an asymptotic Kolmogorov-Smirnov test. Dissert. Abstr.

N79-28969 Yale Univ., New Haven, Conn.
ASYMPTOTIC BEHAVIOR OF SOME DISTRIBUTIONS IN MULTIVARIATE ANALYSIS WITH APPLICATIONS TO TESTING AND ESTIMATION Ph.D. Thesis
Rouh-jane Chou 1978 122 p
Avail: Univ. Microfilms Order No. 7916606

The problems in approximating hypergeometric functions and the extension of some known results are presented. The problems concern the asymptotic behaviors of the density functions of the latent roots in the noncentral Wishart distribution (as the noncentrality parameters become large), in the MANOVA situation (as the error degrees of freedom increase) and in canonical correlation analysis (as the sample size increases). The expansions obtained are used to study the Bartlett-Lawley tests that the residual population roots are zero. An asymptotic representation, valid for large degrees of freedom, is obtained for the density of the noncentral multivariate F matrix which arises in discriminant analysis. Dissert. Abstr.

N79-28970*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NUMBERS OF CENTER POINTS APPROPRIATE TO BLOCKED RESPONSE SURFACE EXPERIMENTS
Arthur G. Holms 1979 34 p refs Presented at 139th Ann. Meeting of the Am. Statistical Assoc., Washington, D. C., 13-16 Aug. 1979
(NASA-TM-79201; E-082) Avail: NTIS HC A03/MF A01 CSCL 12A

Tables are given for the numbers of center points to be used with blocked sequential designs of composite response surface experiments as used in empirical optimum seeking. The star point radii for exact orthogonal blocking is presented. The center point options varied from a lower limit of one to an upper limit equal to the numbers proposed by Box and Hunter for approximate rotatability and uniform variance, and exact orthogonal blocking. Some operating characteristics of the proposed options are described. S.E.S.

N79-28971# Texas A&M Univ., College Station. Inst. of Statistics.
STATISTICAL SCIENCE, STATISTICAL DATA MODELING, AND STATISTICAL EDUCATION
Emanuel Parzen Mar. 1979 21 p refs
(Contract N00014-78-C-0599)
(AD-A067772; TR-N-6) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper is intended to communicate to a general audience current directions in the discipline of statistics, and in my own research. It consists of three parts. Part I (Sections 1-3) explores perspectives on the future development of the science of statistics, and the importance to statisticians and society that each understand the interplay between mathematics, science, and statistics. Definitions are given of mathematical beauty and utility, soft and hard mathematics, mathematical modeling, the distinction between pure science and professional science, and finally statistical science. Part II (Sections 4-7) discusses the steps of statistical reasoning (including exploratory data analysis and statistical model identifications), the quantile and density-quantile approach to statistical data analysis, and time series analysis. Part III (Section 8) presents a model of statistics for organization of graduate instruction. Author (GRA)

N79-28972# Texas A&M Univ., College Station. Inst. of Statistics.
STATISTICAL SCIENCE, STATISTICAL DATA MODELING, AND STATISTICAL EDUCATION
Emanuel Parzen Mar. 1979 22 p refs

(Contract N00014-78-C-0599; Grant DAAG29-78-G-0180)
(AD-A068149; TR-A-6; ARO-16228.6-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper is intended to communicate to a general audience current directions in the discipline of statistics, and in my own research. It consists of three parts. Part I (Sections 1-3) explores perspectives on the future development of the science of statistics, and the importance to statisticians and society that each understand the interplay between mathematics, science, and statistics. Definitions are given of mathematical beauty and utility, soft and hard mathematics, mathematical modeling, the distinction between pure science and professional science, and finally statistical science. Part II (Sections 4-7) discusses the steps of statistical reasoning (including exploratory data analysis and statistical model identifications), the quantile and density-quantile approach to statistical data analysis, and time series analysis. Part III (Section 8) presents a model of statistics for organization of graduate instruction. GRA

N79-28973# Texas A&M Univ., College Station. Inst. of Statistics.
DENSITY QUANTILE ESTIMATION APPROACH TO STATISTICAL DATA MODELLING
Emanuel Parzen Mar. 1979 14 p refs
(Grant DAAG29-78-G-0180)
(AD-A068148; TR-A-5; ARO-16228.5-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper describes the density-quantile function approach to statistical analysis of a sample as involving five phases requiring the study of various population raw and smoothed quantile and density-quantile functions. GRA

N79-28974# Princeton Univ., N. J. Information Sciences and Systems Lab.
SEQUENTIAL DETECTION WITH MARKOV INTERRUPTED OBSERVATIONS
M. T. Hadidi and S. C. Schwartz Apr. 1979 49 p refs
(Contract N00014-77-C-0644)
(AD-A069090; TR-43) Avail: NTIS HC A03/MF A01 CSCL 09/4

We consider the sequential detection of a Markov sequence in a linear system with interrupted observations, i.e., systems with a switching environment. Because of the excessive computational requirements for optimum procedures, three suboptimum filters are discussed, all of which feed into a sequential likelihood-ratio detector. The results of a computer simulation are also presented. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

No abstracts in this category.

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N79-28975 Yale Univ., New Haven, Conn.
THE STRUCTURE OF COMPLEXITY CLASSES AND DEGREES Ph.D. Thesis
Seth Ian Breidbart 1978 82 p
Avail: Univ. Microfilms Order No. 7915803

For a general set of measures of complexity (which include time and space) the universal of the inclusion lattice of honest complexity classes in that measure is shown. A general theorem about this type of construction is proven. Corollaries to this theorem include many other theorems as well as solutions to some of the conjectures and open problems mentioned in Meyer and Ritchie. Dissert. Abstr.

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N79-28976# National Bureau of Standards, Boulder, Colo.
NBS TIME AND FREQUENCY BULLETIN NO. 261
Sandra L. Howe, ed. Aug. 1979 9 p refs
Avail: NTIS HC A02/MF A01

Information is tabulated on the following: (1) time scale; (2) UTI correction and leap second adjustments; (3) phase deviation for WWVB and other NBS-monitoring broadcasts; (4) daily television time transfer measurements using line-10; (5) weekly television frequency transfer measurements using the color subcarrier; (6) broadcast outages over five minute and WWVB phase perturbations; (7) notes on time scales and primary standards; and (8) for users of GOES satellite time code. G.Y.

N79-28977# California Univ., Livermore. Lawrence Livermore Lab.
BALLISTICS TABLES FOR SPHERES 7.5 TO 25 mm (0.3 TO 1 IN.) IN DIAMETER
Donald G. Miller 31 Jan. 1979 93 p refs
(Contract W-7405-eng-48)
(UCRL-52755) Avail: NTIS HC A05/MF A01

A ballistic table was prepared based on modern sphere drag data. The table includes all four Siacci functions, S, T, I, and A. Methods for using the tables are summarized and examples given. Comparisons are made between this small-sphere table and the earlier 100-year-old tables that were based on the drag of large spheres. Some historical background is given, construction of the table is described, and approximations for some ballistic quantities are discussed. Appendixes include summaries of the foundamental ballistic equations, the Siacci approximation, and Siacci formulas for various analytical drag functions. DOE

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N79-28978 Denver Univ., Colo.
AN INVESTIGATION OF ACOUSTIC EMISSION SOURCES IN 1019 STEEL Ph.D. Thesis
Andreas Nicholaou Hadjicostis 1979 162 p
Avail: Univ. Microfilms Order No. 7916120

The acoustic emission behavior of 1019 steel during dynamic loading was investigated. Specimens were made from both hot and cold rolled bar stock and had essentially identical chemical composition. Data were collected from both tension and compression tests. The specimens were subjected to different heat treatments affecting their microstructure before the tests. Plots of acoustic emission profiles were related to load, plastic strain and plastic strain rate. Results of electron microscope examination of specimens at different stages of loading were correlated with acoustic emission data. An interpretation of emission characteristics on the basis of micromechanisms operating during deformation was attempted. Results obtained in the early elastic region, at yield, prior to onset of work hardening and during tensile and compression tests are discussed.
Dissert. Abstr.

N79-28979 Missouri Univ. - Columbia.
DIGITAL DEMODULATION OF HIGH-SPEED QAM WITHOUT TRAINING Ph.D. Thesis
Donald Eugene Gerdes 1978 282 p
Avail: Univ. Microfilms Order No. 7915235

The problem of digitally demodulating quadrature amplitude modulated data transmitted over voice grade telephone channels is analyzed and simulated. No training information or interaction with the transmitter is used. Design of algorithms for front-end processing, carrier acquisition and tracking, symbol timing, and adaptive equalization are described. The front-end processor is designed in detail, but not implemented. Alternative designs for

each of the other sections are considered and at least one algorithm implemented in a computer simulation. Modulation format, approximate carrier frequency, and symbol rate are assumed known. The receiver acquires the carrier frequency and phase and acquires the symbol timing. The equalizer adaptively compensates for channel distortion and demodulates the data. Results of simulations are included which demonstrate the effectiveness of the algorithms. Dissert. Abstr.

N79-28980# Royal Aircraft Establishment, Farnborough (England).
SCATTERING OF A MONOCHROMATIC WAVE BY A TURBULENT FLOW, 4
S. Candel Feb. 1979 28 p refs Transl. into ENGLISH of "Diffusion d'une Onde Monochromatique par un Ecoulement Turbulent 4", Rept. ONERA-TP-L39-388(A) ONERA, Paris, 1977
(RAE-LIB-TRANS-1991; BR68215) Avail: NTIS HC A03/MF A01

In order to study the structure and radiation of aerodynamic noise sources, an anechoic open-jet wind tunnel was used. The sound field generated by the source is modified outside the jet by interactions which occur as the sound waves propagate through the mixing layer of the free jet. In the case of a monochromatic wave (1 kHz less than or equal to f sub O less than or equal to 100 kHz), interaction with turbulence changes the phase and amplitude. The comparison between the spatio-temporal structure of the aerodynamic velocity field, and that of the sound field characterized by fluctuation in the phase and amplitude, shows the propagation effect of large-scale turbulent structures which are convected in the jet shear layer. Tests were conducted which measured simultaneously the acoustic pressure and the velocity fluctuations in the mixing layer. The method of analysis and the theoretical approach developed for the interpretation of the measurements are presented. G.Y.

N79-28981*# Hampton Inst., Va.
A MODEL FOR THE NOISE RADIATED BY TURBULENT BOUNDARY LAYERS AND ITS INTERACTION WITH LAMINAR LAYERS IN SUPERSONIC FLOW Final Technical Report, 31 Mar. 1978 - 31 Jul. 1979
M. R. Schopper 1979 37 p refs Presented at AIAA 12th Fluid and Plasma Dyn. Conf., Williamsburg, Va., 23-25 Jul. 1979
(Grant NsG-1505)
(NASA-CR-158806; AIAA-Paper-79-1523) Avail: NTIS HC A03/MF A01 CSCL 20A

Motivated by the noise-boundary layer transition problem in supersonic flow, the interaction between incoming aerodynamic noise and the laminar boundary layer was studied. The noise field was modeled as a Mach wave radiation field consisting of discrete waves emanating from coherent turbulent entities moving downstream within the supersonic turbulent boundary layer. The individual disturbances are likened to miniature sonic booms and the laminar boundary layer is strafed by the waves as the sources move downstream. The mean, autocorrelation, and power spectral density of the field are expressed in terms of the wave shapes and their average arrival rates. The emphasis in the interaction analysis is on the behavior of the shocklets in the noise field. The shocklets are shown to be focused by the laminar boundary layer in its outer region. Borrowing wave-propagation terminology, this region is termed the caustic region. Using scaling laws from sonic boom work, focus factors at the caustic are estimated to vary from 2 to 6 for incoming shocklet strengths of 1 to .01 percent of the free stream pressure level. The situation regarding experimental evidence of the caustic region is reviewed. It is not clear whether the focusing effectively promotes early transition. Additional observations concerning the interaction problem are presented. Author

N79-28982*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
JET NOISE AND PERFORMANCE COMPARISON STUDY OF A MACH 2.55 SUPERSONIC CRUISE AIRCRAFT
V. R. Mascitti and D. J. Maglieri Jun. 1979 24 p refs
(NASA-TM-80094) Avail: NTIS HC A02/MF A01 CSCL 20A

Data provided by the manufacturer relating to noise and performance of a Mach 2.55 supersonic cruise concept employing a post 1985 technology level, variable cycle engine was used to identify differences in noise levels and performance between the manfacturer and NASA associated with methodology and groundrules. In addition, economic and noise information is provided consistent with a previous study based on an advanced technology Mach 2.7 configuration. The results indicate that the difference between the NASA's and manfacturer's performance methodology is small. Resizing the aircraft to NASA groundrules also results in small changes in flyover, sideline and approach noise levels. For the power setting chosen, engine oversizing resulted in no reduction in traded noise. In terms of summated noise level, a 10 EPNdB reduction is realized for an 8 percent increase in total operating costs. This corresponds to an average noise reduction of 3.3 EPNdB at the three observer positions. A.R.H.

N79-28983# Naval Research Lab., Washington, D. C.
FORTRAN PROGRAMS FOR NUMERICAL AND GRAPHICAL ANALYSIS OF ELASTIC RESPONSE, RADIATED SOUND PRESSURE, AND REFLECTED SOUND PRESSURE FOR PLANE PLATE STRUCTURES WITH FLUID ON ONE SIDE
Martin D. Ring 12 Apr. 1979 81 p
(RR0110842)
(AD-A067912; NRL-MR-3885) Avail: NTIS HC A05/MF A01 CSCL 20/1

A computer program is developed to compute radiated and reflected sound pressures as a function of angle at a given frequency or as a function of frequency at a given angle for infinite plate structures excited by a point force or by plane acoustic waves. The plate structures have a fluid on one side, and air on the other. To compute radiated and reflected pressures, it is necessary to compute the elastic response function and several characteristics parameters of the structure. The ability to change the way in which these calculations are computed is a major factor in program design. Author (GRA)

N79-28984*# Massachusetts Inst. of Tech., Cambridge. Fluid Dynamics Research Lab.
EXPERIMENTAL AND THEORETICAL STUDIES ON MODEL HELICOPTER ROTOR NOISE Interim Report, Mar. 1976 - Dec. 1977
Krishnaswamy S. Aravamudan and Wesley L. Harris Jan. 1978 158 p refs Submitted for publication
(Grant NsG-2095; Contract DAAG29-76-C-0027)
(NASA-CR-158844; AD-A068180; ARO-12931.2-EX; Rept-83852-1; Rept-78-1) Avail: NTIS HC A08/MF A01 CSCL 20/1

A simplified Mach number scaling law is obtained for rotational and broadband noise components of a model helicopter rotor. The broadband noise sources are further classified into low frequency and high frequency components. The scaling laws are based on the geometric and performance parameters of the rotor and characteristics of the flow field. The existing theory of Lowson and Ollerhead is used deriving the conventional sixth power law for the rotational noise of geometrically similar blades operating in similar flow environments. The knowledge of unsteady aerodynamics was exploited to yield analytical formulation for the low frequency broadband radiation. The ambiguous state of the art regarding the origin and nature of high frequency broadband noise does not permit such a straightforward scaling law for this frequency regime. Vortices are assumed to be shed at unknown Strouhal frequency and the scaling law is derived by simply integrating the blade sectional velocity over the span. The MIT 5 x 7-1/2 foot anechoic wind tunnel was used to perform experiments at controlled flow environ. Turbulence was generated at the inlet of the tunnel and simultaneous measurements of acoustic and turbulence signals were made. The experimentally obtained results are compared with the computed intensities and spectra of rotational noise, low frequency broadband noise and high frequency broadband noise from model rotors. GRA

N79-28985# Naval Ship Research and Development Center, Bethesda, Md. Acoustics Dept.
NOISE RADIATION FROM SUBSONIC AIR FLOW THROUGH SINGLE AND MULTIHOLED ORIFICE PLATES Interim Report

F. C. DeMetz, M. F. Matis, R. S. Langley, and J. L. Wilson Feb. 1979 41 p refs
(ZR0110801)
(AD-A069087; DTNSRD/SAD-237E-1942) Avail: NTIS HC A03/MF A01 CSCL 20/1

The mechanisms and scaling laws for noise radiated from subsonic airflow through single and multiholed orifice plates have been studied experimentally. Simultaneous measurements were conducted of the velocity field and radiated pressure associated with jets formed downstream of sharp-edged, multiholed orifice plates. The orifice plates, containing from 1 to 31 holes, were placed at the termination of a quiet 76-millimeter inside diameter airflow facility. The characteristics of the broadband and tonal components of the radiated noise field are evaluated in terms of: (1) the orifice plate hole geometries and flow interactions and (2) the downstream jet features. GRA

N79-28986# Duke Univ., Durham, N. C. Dept. of Electrical Engineering.
ADAPTIVE LINEAR ESTIMATION ALGORITHMS APPLIED TO SPECTRAL LINE ENHANCEMENT
Stephen D. Huffman Aug. 1978 338 p refs
(Contract N00014-75-C-0191)
(AD-A068760; TR-15) Avail: NTIS HC A15/MF A01 CSCL 09/3

In this report, the performance characteristics of the LMS Gradient Algorithm, two Adaptive Fixed-Point Iteration Algorithms and of a non-iterative method based on Levinson's Algorithm are considered for the case where an adaptive algorithm is used to determine the unit sample response for a system which attempts to discriminate between the signal and noise processes on the basis of bandwidth. Such a system is often referred to as a Spectral Line Enhancer. Theoretical bounds on the mean-square error as a function of the time index n are derived for each of the three iterative methods. A comparison of these bounds is made for the case where the input data to the Spectral Line Enhancer is composed of a single sinusoid of random phase in the presence of an additive autoregressive noise sequence. The results of extensive computer simulations of the adaptive algorithms considered are used to determine the usefulness of the theoretical bounds and to make comparisons of the performance of the four methods. GRA

N79-28987# Texas Univ. at Austin. Applied Research Labs.
ASPECTS OF THE ACOUSTIC BOTTOM INTERACTION PROBLEM Final Report, 10 Jan. - 30 Dec. 1977
Kenneth E. Hawker 7 Dec. 1978 59 p refs
(Contract N00039-77-C-0003)
(AD-A068733; ARL-TR-78-49) Avail: NTIS HC A04/MF A01 CSCL 20/1

This report is a synopsis of work carried out during 1977 on acoustic interaction with the sea floor. Results are reported concerning roughness effects, mode stripping effects on the depth dependence of propagated sound fields, vertical directivity consideration, bottom loss sensitivity studies, and other related studies. The bulk of the material summarized here has been previously reported in original form in various papers and reports. Author (GRA)

N79-28988# Atomics International Div., Golden, Colo. Rocky Flats Plant.
ACOUSTIC EMISSION GENERATED BY DISLOCATION MECHANISMS DURING THE DEFORMATION OF METALS
C. R. Heiple 1978 71 p refs Presented at Joint Meeting of Acoustical Soc. of Am. and Japan, Honolulu, Hawaii, 1 Dec. 1978
(Contract EY-76-C-04-3533)
(RFP-2820; Conf-781237-1) Avail: NTIS HC A04/MF A01

Models for acoustic emission from plastic deformation sources are presented and discussed. The effects of the experiment and material variables are examined with emphasis on the test temperature, sample size and purity, grain size, and prior mechanical work and heat treatment. DOE

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N79-28989 Kansas State Univ., Manhattan.
A STUDY OF QUENCHING REACTIONS FOR THE RARE GAS METASTABLE ATOMS WITH EMPHASIS ON Kr (3P2) Ph.D. Thesis
John Henry Kolts 1978 301 p
Avail: Univ. Microfilms Order No. 7915176

The decay constants for Ar(3P0), Ar(3P2), Kr(3P2) and Xe(3P2) in pure argon carrier gas were measured, as well as total quenching rate constants for the reaction of Kr(3P2) with several halogen and nonhalogen containing molecules. The flowing afterglow technique was used; the metastable atoms were produced by passing either pure argon or a mixture of krypton or xenon in argon through a cold cathode discharge. The loss of metastables downstream from the discharge was monitored using atomic absorption spectroscopy as a function of time and reactor pressure or reagent concentration. The rate constants found include the diffusion coefficient, two-body deactivation rate and three body rate. The results for each of the three processes are discussed in terms of the physical models. The electronic states of the rare gas halogen excimers and resulting emission spectra are discussed and assigned to two major transitions. Dissert. Abstr.

N79-28990 California Univ., Berkeley.
VIBRATIONAL ENERGY TRANSFER IN SELECTIVELY EXCITED DIATOMIC MOLECULES Ph.D. Thesis
Cameron John Dasch 1978 254 p
Avail: Univ. Microfilms Order No. 7914577

Single rovibrational states of HCl(v=2), HBr(v-2), DCl(v=2), and CO(v=2) were excited with a pulsed optical parametric oscillator (OPO). Total vibrational relaxation rates by near - resonance quenchers were measured at 295 K using time resolved infrared fluorescence. These rates are attributed primarily to V - V energy transfer, and they generally conform to a simple energy gap law. A small deviation was found for the CO(v) + DCl(v prime) relaxation rates. Upper limits for the self relaxation by V - R,T of HCl(v=2) and HBr(v=2) and for the two quantum exchange between HCl and HBr were determined. The HF dimer was detected at 295 K and 30 torr HF pressure with an optoacoustic spectrometer using the OPO. Pulsed and chopped, resonant and nonresonant spectrophones were analyzed in detail. From experiments and first order perturbation theory, these V - V exchange rates appear to behave as a first order perturbation in the vibrational coordinates. Dissert. Abstr.

N79-28991 Yale Univ., New Haven, Conn.
THE COMPLETE SECOND-ORDER HELIUM FINE STRUCTURE AND A PRECISE DETERMINATION OF THE FINE STRUCTURE CONSTANT Ph.D. Thesis
Paul Hans Serafino 1978 191 p
Avail: Univ. Microfilms Order No. 7916521

For the theoretical assessment of the 2 3P helium fine structure to become comparable to the precision measurements that were made, it is necessary that the theory be calculated through order (alpha to the 56th power)(m)(c squared). In particlar, the second-order contribution from the Breit and mass-polarization operators must be evaluated to an accuracy of about one per cent. For each of five possible intermediate state symmetries the Dalgarno-Lewis method was used to obtain the first-order energy perturbed wave functions from which the second-order energy follows by integration. Both the perturbed and unperturbed wave functions were explained in Hylleraas-type series with progressively larger numbers of terms, the second-order energies being computed at each stage; up to 455 terms are used for 3P intermediate states and up to 286 for 1P, 3D, 1D, and 3F. Dissert. Abstr.

N79-28992 Illinois Univ. at Urbana-Champaign.
STUDIES IN THE ELECTRONIC STRUCTURE OF MATTER Ph.D. Thesis
Donald Lynn Miller 1979 213 p
Avail: Univ. Microfilms Order No. 7915400

KLL Auger transition rates for helium are computed using simple atomic orbital wavefunctions which take into account the difference in average electron-electron repulsion of initial and final states. A method for extracting atomic pseudopotentials from photoelectron angular distributions is described and applied photoionization of the outermost p shells of Ar, Kr, and Xe and to the 4d shell of Xe. The extended Huckel theory is applied to the nitrogen trap in GaAs and GaP. Perfect crystal band structures are computed and are shown to be in reasonable agreement with those computed with empirical pseudopotentials.
Dissert. Abstr.

N79-28993 Ohio State Univ., Columbus.
FOCUSING OF PHOTON ECHOES IN SODIUM VAPOR Ph.D. Thesis
Neil Charles Griffen 1979 164 p
Avail: Univ. Microfilms Order No. 7915981

The theory for the production of photon echoes was developed and used to determine the conditions for focusing of photon echoes. Starting from the density matrix formulation of the Schrodinger Equation, a time evolution operator is used to trace the effects of the pulses on an atomic or molecular system. An argon ion laser pumped dye laser was used to produce a continuous, narrow bandwidth signal at either of the Na D lines. This was amplified by a nitrogen laser pumped dye amplifier. The theoretical development of a nondamped case was extended to include damping effects by the use of phenomenological equations. The results are compared to the nondamped case.
Dissert. Abstr.

N79-28994 North Carolina Univ. at Chapel Hill.
A THEORETICAL STUDY OF RADIATIVE COLLISIONS Ph.D. Thesis
Edward Older Edney, III 1978 138 p
Avail: Univ. Microfilms Order No. 7914344

A semiclassical theory is developed which describes atomic scattering in the presence of an intense laser field. As a preliminary step in the development of this radiative theory, a field-free semiclassical theory is constructed which is complete and describes motional quantal interference phenomena. This theory is applied to radiative collisions for both single and three photon transitions and includes high-field effects such as nonrotating wave contributions. Radiative resonant scattering and collisions involving multiple crossings are examined. Numerical examples are provided which demonstrate how the radiative S-matrix elements depend on experimentally controlled variables such as laser frequency, kinetic energy of the colliding system, and laser power.
Dissert. Abstr.

N79-28995 Rochester Univ., N. Y.
INVESTIGATION OF PHOTON CORRELATIONS IN RESONANCE FLUORESCENCE Ph.D. Thesis
Mario Dagenais 1978 205 p
Avail: Univ. Microfilms Order No. 7914464

Sodium atoms in an atomic beam are excited by a perpendicular light beam from a tunable dye laser, after having been prepared by optical pumping to behave as two level quantum systems. Photoelectric pulse correlations are measured in the presence of exciting fields of various strengths and for various detunings from the atomic resonance, when the average number of atoms in the interaction region is less than one, and are found to exhibit significant nonclassical features. Photon antibunching is detected for the first time. This provides rather direct evidence for an atom undergoing a quantum jump in the process of emission. The theory that applies directly to this type of experiment is worked out in the framework of quantum electrodynamics. The normalized intensity correlation function is extracted from the measurements and quantitative agreement is found between theory and experiment.
Dissert. Abstr.

N79-28996 Ohio State Univ., Columbus.
COHERENT TWO-PHOTON INTERACTIONS WITH ATOMIC SODIUM VAPOR Ph.D. Thesis
Richard Lee Sutherland 1979 152 p
Avail: Univ. Microfilms Order No. 7916031

Two-photon interactions in atomic sodium vapor are considered both theoretically and experimentally. Since the frequencies of the radiation fields which are incident on the sodium are tunable, both resonant and nonresonant behaviors are described. To describe the nonresonant behavior in sodium quantum mechanical perturbation theory using the density matrix, formalism is employed, and a macroscopic electric polarization which oscillates at the sum-frequency of the two incident fields is derived. For resonant behavior, the unitary matrix which describes the time evolution of the density matrix elements was derived. The dependence of the sum-frequency generation in sodium on the presence of argon gas at various pressures was also studied.
Dissert. Abstr.

N79-28997 Maryland Univ., College Park.
ORDER OF SCATTERING CALCULATIONS OF PHOTON AND NEUTRON TRANSPORT Ph.D. Thesis
Nelson Lee DeGangi 1978 207 p
Avail: Univ. Microfilms Order No. 7915800

Integral equations are placed into a form conducive to numerical integration so as to provide angular and total multigroup fluxes. Simplifications arising with low order scattering terms are incorporated into the numerical relations. A FORTRAN 5 program, MORSCAT, was written to solve the developed equations. Coding from the MORSE-CG code was utilized. Spatial discretization is performed through the use of a ray tracing technique. Angular scattering dependence is described with step functions that are generated from Legendre coefficients. Several calculations were performed which illustrate that the low order scattering relations were properly handled. A reasonable agreement was seen.
Dissert. Abstr.

N79-28998*# National Aeronautics and Space Administration, Washington, D. C.
EVOLUTIONAL SCHEMES FOR OBJECTS WITH ACTIVE NUCLEI
B. V. Komberg Jun. 1979 29 p refs Transl. into ENGLISH of "Evolyutsionnyye Skhemy Obyektov s Aktivnymi Yadrami", Rept. Pr-445 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1978 p 1-27 Transl. by Sci. Transl. Serv., Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75636; Pr-445) Avail: NTIS HC A03/MF A01 CSCL 20H

The observational properties of quasistellar objects (QSO) reveal that they are extremely violent nuclei of distant galaxies, but the evolutionary stage of these galaxies is still undetermined. Various published attempts to classify QSO under different criteria - including the one based on the morphological type of the surrounding galaxy E- or S- are analyzed. There are evidences that radioactive quasars reside in E-, while radio-quiet quasars reside in both E- and S- systems. The latter may be evolutionary connected to Seyfert-like objects. A correlation between the nuclei activity level in systems of different morphological type and the relative amount of gas in them is noted. From the point of view of activity level and the duration of active stage of nuclei it is concluded that an interaction of galaxies with the intergalactic medium is of particular importance and must be most conspicuous in spheriodal systems of central regions of rich clusters, in tight groups and binary galaxies.
A.R.H.

N79-28999# Texas A&M Univ., College Station. Dept. of Chemistry.
ELECTRONIC STRUCTURE OF AND BONDING IN ANTIMONY PHTHALOCYANINE COMPLEX Interim Report
M. Tsutsui, Darrell D. Axtell, and K. Tatsumi 15 Apr. 1979 13 p refs
(Contract N00014-75-C-0417)
(AD-A068996; TR-28) Avail: NTIS HC A02/MF A01 CSCL 07/3

Although the elemental analysis of the product, antimony phthalocyanine, seems to fit for the formula PcSb2, it is difficult to figure out the possible structure for the formula by ordinary valency requirement of antimony. Crystalization from THF gave rise to a decomposition of the compound and UV and visible spectroscopy were not effective for the structural study. The X-ray electron spectroscopy and Raman spectroscopy was then used in order to elucidate the structure.
GRA

N79-29000# Georgetown Univ., Washington, D.C. Dept. of Chemistry.

LANTHANIDE IONS AS SENSITIVE PROBES IN INTERMOLECULAR ENERGY TRANSFER AND ORGANIC PHOTOCHEMISTRY Final Report
N. Filipescu Aug. 1978 16 p refs
(Contract EY-76-S-05-3797)
(ORO-3797-65) Avail: NTIS HC A02/MF A01

The process of energy transfer from selected organic sensitizers to lanthanide ion acceptors such as trivalent europium and terbium was investigated. A variety of compounds were tested for ability to transfer electronic excitation energy to the rare-earth ions. Selected aromatic carbonyl sensitizers found to be efficient triplet energy donors were used in transfer experiments in both liquid solutions and rigid matrices. Measurement of sensitized rare-earth fluorescence, in combination with the donor emission and excitation data, allowed accurate evaluation of rate constants for individual radiative and radiationless processes. DOE

N79-29001# Oak Ridge National Lab., Tenn.
ANALYSIS OF A NUCLEAR BACKSCATTERING AND REACTION DATA BY THE METHOD OF CONVOLUTION INTEGRALS
M. B. Lewis Feb. 1979 39 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6697) Avail: NTIS HC A03/MF A01

A quantitative description of nuclear backscattering and reaction processes is made. Various formulas pertinent to nuclear microanalysis are assembled in a manner useful for experimental application. Convolution integrals relating profiles of atoms in a metal substrate to the nuclear reaction spectra obtained in the laboratory are described and computed. Energy straggling and multiple scattering are explicitly included and shown to be important. Examples of the application of the method to simple backscattering, oxide films, and implanted gas are discussed. DOE

N79-29002# California Univ., Livermore. Lawrence Livermore Lab.
DISK-CYLINDER METHOD FOR USING NMR TO MEASURE MAGNETIC SUSCEPTIBILITY
A. K. Burnham 21 Dec. 1978 19 p refs
(Contract W-7405-eng-48)
(UCID-18010) Avail: NTIS HC A02/MF A01

The sphere-cylinder method of using nuclear magnetic resonance (NMR) to measure the magnetic susceptibility of diamagnetic and paramagnetic materials were generalized to the disk-cylinder method. A two-fold increase in sensitivity was obtained. Accuracies of 0.1 percent of the diamagnetism of water should be readily obtainable. DOE

N79-29003# Rutherford Lab., Chilton (England).
PARTON RECOMBINATION MODEL INCLUDING RESONANCE PRODUCTION
R. G. Roberts, R. C. Hwa (Oregon Univ., Eugene), and S. Matsuda (Kyoto Univ., Japan) May 1978 24 p refs
(Contract EY-76-S-06-2230-004)
(DOE/ER/70004-209; RLO/2230/T4-209; RL-78-040) Avail: NTIS HC A02/MF A01

Possible effects of resonance production on the meson inclusive distribution in the fragmentation region are investigated in the framework of the parton recombination model. From a study of the data on vector-meson production, a reliable ratio of the vector-to-pseudoscalar rates is determined. Then the influence of the decay of the vector mesons on the pseudoscalar spectrum is examined, and the effect found to be no more than 25% for $x > 0.5$. The normalization of the non-strange antiquark distributions are still higher than those in a quiescent proton. The agreement between the calculated results and data remains very good. DOE

N79-29004# California Univ., Berkeley. Lawrence Berkeley Lab.
PRODUCTION AND DECAY OF CHARMED PARTICLES IN e(+)e(-) COLLISIONS
A. Barbaro-Galtieri Dec. 1978 69 p refs Presented at the 14 Intern. School of Subnucl. Phys., Erice, Italy, 31 Jul. - 11 Aug., 1978
(Contract W-7405-eng-48)
(LBL-8537) Avail: NTIS HC A04/MF A01

All the data available on production and decay of charmed particles in e(+)e(-) collisions are reviewed. Production and decay of D^*,D,F mesons and charmed baryons are discussed. Comparisons with theoretical predictions, where available, are made. DOE

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N79-29005 Kansas State Univ., Manhattan.
ON THE APPLICATIONS OF DISCRETE ORDINATES METHOD TO GAMMA PHOTON TRANSPORT Ph.D. Thesis
Jeffrey Clair Ryman 1979 331 p
Avail: Univ. Microfilms Order No. 7915182

Several computational considerations for using exact kernel cross sections are investigated and techniques are presented which will reduce the effort needed for cross section evaluation and will improve the convergence acceleration of the solution of the discrete ordinates equations. Improvements in treating highly anisotropic gamma photon transport problems are applied to an important radiological problem. It is shown that the effect of the air-ground interface upon gamma-ray submersion dose is not always to reduce the dose by one-half from that which would be received by a person immersed in an infinite cloud source. The correct ratio of the air dose one meter above the air-ground interface to that from an infinite cloud source is shown to be about one-half for high source gamma-ray energies, to decrease for intermediate energies, and then to rise sharply to unity for very low source gamma-ray energies. Dissert. Abstr.

N79-29006 Georgia Inst. of Tech., Atlanta.
ELECTRON SELF-TRAPPING IN STRUCTURALLY DISORDERED MEDIA Ph.D. Thesis
Ricky Lamar Moore 1979 134 p
Avail: Univ. Microfilms Order No. 7916064

In thermal equilibrium, minimization of the free energy functional describing an electron interacting in a mean field approximation with a disordered media, leads to a nonlinear Schrodinger equation for the electron wave function. Solutions of this equation described a self-trapped electron in a potential well. Numerical and variational techniques are utilized to obtain solutions to this differential equation and conditions on system parameters for dense gases are found which limit the formation of such self-trapped states. Further calculations indicate that non-ideal gas behavior must be incorporated to properly described trapped state formation. A Frank-Condon model is utilized to calculate dipole matrix elements for 1s-1p transitions. This last calculation implies that infrared spectroscopy may furnish important information about the structure of the self-trapped electron in helium gas. Dissert. Abstr.

N79-29007 California Univ., Los Angeles.
A SEARCH FOR QUARK EFFECTS IN LIGHT NUCLEAR SYSTEMS Ph.D. Thesis
John Benjamin McClelland 1979 77 p
Avail: Univ. Microfilms Order No. 7915669

The inclusive measurement of the cross-section for the reaction d + alpha yields p + X was measured in the center of mass energy range of 6.25 to 7.91 GeV, corresponding to excitation energies of .3 to 2.4 GeV, in steps of 50 to 100 MeV. Exotic quark states are hypothesized to show up as resonances in the inelastic channel as a function of center of mass energy. No such states were observed to the sensitivity of the measurement. The region encompassing decay particles from 50 to 400 MeV kinetic energy in the center of mass system was measured. In making this measurement the deuteron fragmentation cross-sections for incident deuteron momenta from 2.22 to 3.29 GeV/c and transverse momenta of 150 to 400 MeV/c were also obtained. Dissert. Abstr.

N79-29008 California Univ., Berkeley.
HIGH TEMPERATURE MATTER AND HEAVY ION COLLISIONS Ph.D. Thesis
Joseph Irving Kapusta 1978 144 p
Avail: Univ. Microfilms Order No. 7914655

The possibility that collisions between heavy ions at relativistic energies lead to the formation of high temperature matter is considered. The studies were motivated by Hagedorn's theory of a limiting temperature, by the Lee-Wick discussion of abnormal nuclear matter, by the candidate theory of the strong interactions quantum chromodynamics, and by the availability of relativistic heavy ion beams. The formalism necessary to accommodate particle production in a nuclear fireball model when there are conserved quantum numbers is developed. Using diffuse nuclear matter distributions for the colliding nuclei, detailed comparisons with data were carried out. In order to investigate the properties of very high temperature matter the thermodynamic potential of quantum chromodynamics is calculated perturbatively.
Dissert. Abstr.

N79-29009 Illinois Univ. at Urbana-Champaign.
RESONANT PHOTON SCATTERING FROM ISOTOPES OF LEAD AND BISMUTH Ph.D. Thesis
Thomas Edward Chapuran 1979 165 p
Avail: Univ. Microfilms Order No. 7915331

Nuclear resonant photon scattering from Pb-206,-207,-208 and Bi-209 was measured over excitation regions from 4 MeV to the neutron thresholds, using bremsstrahlung beams with endpoint energies of 7.0, 7.5, 7.6, 8.5 and 10.4 MeV. Energies and values of gGamma sub 0 to the 2d power/Gamma were determined from measurements at 127 degrees for many levels not previously observed in photon scattering experiments. Spins of levels in Pb-206 and Pb-208 were determined from angular distribution measurements. Ground state branching ratios for seven transistions in Pb-208 were obtained from a self-absorption experiment. The results are compared with results from earlier spectroscopic studies and from average photon scattering cross section measurements. The spectra of Pb-207 and Bi-209 are discussed in terms of the excitations of the Pb-208 core.
Dissert. Abstr.

N79-29010 Rochester Univ., N. Y.
INCLUSIVE CHARGED-PARTICLE PRODUCTION IN NEUTRON-NUCLEUS COLLISIONS AT HIGH ENERGY Ph.D. Thesis
David Hall Chaney 1978 113 p
Avail: Univ. Microfilms Order No. 7914463

Data on positive and negative particles produced in nuclei (ranging in atomic number (A) from beryllium to lead) are presented for essentially the full forward hemisphere of the center-of-mass system. A rough pion-proton separation is achieved for the positive spectra. Fits of the form A to the alpha power to the cross sections are presented as functions of transverse momentum, longitudinal momentum, rapidity, and pseudo-rapidity. It is found that alpha changes from approximately 0.85 to approximately 0.60 for laboratory rapidities ranging from 4 to 8. Differences in the data at large rapidity and large pseudo-rapidity are shown. The major features of the data can be understood in terms of current particle-production models. Dissert. Abstr.

N79-29011 Maryland Univ., College Park.
A SEARCH FOR LONG-LIVED NEUTRAL HEAVY LEPTONS IN 400 GeV/c PROTON-NUCLEON INTERACTIONS Ph.D. Thesis
Dennis John Bechis 1978 124 p
Avail: Univ. Microfilms Order No. 7915780

The production of long-lived neutral heavy leptons was searched for in 400 GeV/c proton-nucleon interactions in a magnetized beamdump. It was required that the leptons be produced without accompanying muons of energy greater than 10 GeV, that they traverse the beamdump, and that they decay into charged particles in a 9.2 m long evacuated pipe whose front end was located 8.9 m downstream. These decay products were analyzed by a magnetic spectrometer employing multi-wire proportional chambers and scintillation counters.
Dissert. Abstr.

N79-29012 Rochester Univ., N. Y.
CONSIDERATIONS OF NONRELATIVISTIC KAPITZA-DIRAC SCATTERING Ph.D. Thesis
John Kinghorn McIver, Jr. 1978 166 p
Avail: Univ. Microfilms Order No. 7914483

The transition probability for an electron to scatter in a standing wave, Kapitza-Dirac scattering, is calculated for three different standing wave models. When the electron Hamiltonian is time averaged and the standing wave is suddenly switched on and monochromatic, the resulting expression for the scattering probability is valid for any standing wave intensity I, for any electron interaction time t, and any initial and final momenta. The solution predicts that the scattering probability oscillates as a function of the field intensity when t is a constant. An experiment designed to measure scattering probabilities is described. No scattered electrons were detected because the electron beam proved to be unstable.
Dissert. Abstr.

N79-29013# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ORIGIN OF DIFFUSE GALACTIC GAMMA-RAYS
Satio Hayakawa May 1979 30 p refs Presented at COSPAR Symp. on Gamma-Rays, Bangalore, India, 30 May - 1 Jun. 1979
(IPPJ-389) Avail: NTIS HC A03/MF A01

Theoretical interpretations of the diffuse component of galactic gamma-rays with energies around 100 MeV are reviewed. Correlations of the gamma ray intensity with various astronomical objects indicate that the gamma ray emissivity is roughly proportional to the square of the interstellar gas density and also to the infrared emissivity. The energy spectrum of gamma rays does not show the turn over expected from the pion decay, suggesting a large contribution of the bremsstrahlung and/or Compton scattering electrons. The contribution of the latter is estimated by reference to the starlight density which is found largely through infrared observation. The contribution of localized sources to the diffuse component is discussed in connection with the star formation in dense molecular clouds. M.M.M.

N79-29014# Naval Research Lab., Washington, D. C.
RADIAL EXPANSION OF A SELF-PINCHED BEAM WITH DISTRIBUTED ENERGY Interim Report
Michael I. Haftel, Martin Lampe, and Joseph B. Aviles Jan. 1979 55 p refs
(Contract RF32391801)
(AD-A066179; AD-E000266; NRL-MR-3908) Avail: NTIS HC A04/MF A01 CSCL 02/7

The structure and radial expansion of a relativistic particle beam are calculated in the presence of Coulomb scattering. The beam is assumed to be self-pinched and paraxial, but to have a distribution in energy. GRA

N79-29015# Physics International Co., San Leandro, Calif.
DEVELOPMENT OF AN INTENSE ELECTRON BEAM ENVIRONMENT FOR MATERIAL CHARACTERIZATION Final Report, 1 Sep. 1976 - 27 Oct. 1978
D. Darkin Oct. 1978 66 p refs
(Contract DNA001-76-C-0362)
(AD-A069155; AD-E300519; PIFR-21-979; DNA-4720F) Avail: NTIS HC A04/MF A01 CSCL 20/7

An intense relativistic electron beam environment has been developed for material characterization. Experimental results on the magnetic compression and expansion of intense beams are presented and compared with theoretical models; emphasis is given to transport efficiency, electron angular distributions, and beam uniformity. Diode energies of 75 kJ are achieved (DNA OWL 2 generator) with greater than 80 percent transport efficiency using a magnetic compression ratio of three. Experimental results have been analyzed in terms of the physics of diode impedance lifetime. Several diagnostics essential for characterizing these intense beams have been successfully demonstrated. GRA

N79-29016# Brookhaven National Lab., Upton, N. Y.
DYNAMICS OF THE COMPOSITION OF A HYDROGEN BEAM IN A HYDROGEN TARGET
V. M. Kulygin and A. A. Panasenkov 1978 21 p refs Transl. into ENGLISH from Preprint IAE-2993, (Moscow), 1978
(BNL-Tr-673; IAE-2993) Avail: NTIS HC A02/MF A01

The composition of the neutral beam injected into the

apparatus is determined by the composition of the ion beam extracted from the source and by the thickness of the charge-exchange target. On the basis of the well-known cross sections of the elementary processes, the transmission of hydrogen beams through the hydrogen target was calculated in a wide energy range. DOE

N79-29017# Argonne National Lab., Ill.
PERSPECTIVE OF METAL ENCAPSULATION OF WASTE
L. J. Jardine and M. J. Steindler 1978 13 p refs Presented at In-Situ Conf. Mater. Res. Soc., Boston, 29 Nov. - 1 Dec. 1978
(Contract W-31-109-eng-38)
(CONF-781172-5) Avail: NTIS HC A02/MF A01

A conceptual flow sheet is presented for encapsulating solid, stabilized calcine (e.g., supercalcine) in a solid lead alloy, using existing or developing technologies. Unresolved and potential problem areas of the flow sheet are outlined and suggestions are made as how metal encapsulation might be applied to other solid wastes from the fuel cycle. It is concluded that metal encapsulation is a technique applicable to many forms of solid wastes and is likely to meet future waste isolation criteria and regulations. DOE

N79-29018# Department of Energy, Washington, D. C.
REPORT OF THE INTERNATIONAL SUBGROUP OF THE INTERAGENCY REVIEW GROUP ON NUCLEAR WASTE MANAGEMENT
[1979] 16 p
(TID-28903-Draft) Avail: NTIS HC A02/MF A01

It is concluded by the subgroup that to realize international goals, the U.S. will need to store some foreign spent fuel in an Away From Reactor (AFR) storage facility. The close relation of the U.S. nuclear programs to those aboard and the need for timely decisions and concrete progress in U.S. programs are pointed out. The basic U.S. attitude toward nuclear waste management, international cooperation, and international initiatives, including INFCE, are discussed. Author (DOE)

N79-29019# Connecticut Univ., Storrs.
SPIN DEPENDENCE OF THE DEUTERON-NUCLEUS INTERACTION AS AFFECTED BY BREAKUP
G. H. Rawitscher and S. N. Mukherjee 1978 19 p refs Presented at Symp. on Direct Reactions, Fukuoka, Japan, 25 Oct. 1978
(Contract EG-77-S-02-4444)
(COO-4444-2; Conf-781058-3) Avail: NTIS HC A02/MF A01

The effect of breakup on the elastic deuteron-nucleus scattering elements S/sub L, L prime/sup J/ is calculated numerically for deuterons incident on 64Ni for the energies of 13, 21.6, and 45 MeV. The S's are decomposed into central, spin orbit and tensor components. All three are affected strongly by breakup, and so are the various polarization angular distributions. The calculation proceeds in second order distorted wave Born approximation and includes breakup energies up to 40 MeV divided into two bins. Three values of the neutron-proton relative angular momenta j = 1, 2, and 3 are included. Comparison with experiment at 45 MeV for d sigma/d Omega and T sub 11 is presented. DOE

N79-29020# California Univ., Livermore. Lawrence Livermore Lab.
LLL EVALUATED-NUCLEAR-DATA LIBRARY (ENDL): GRAPHS OF CROSS SECTIONS FROM THE LIBRARY
R. J. Howerton, D. E. Cullen, M. H. MacGregor, S. T. Perkins, and E. F. Plechaty 31 Oct. 1978 15 p refs
(Contract W-7405-eng-48)
(UCRL-50400-Vol-15-Pt-B-Rev-1) Avail: NTIS HC A02/MF A01

Graphs of neutron cross sections and related parameters for the LLL ENDL are presented. The evaluated nuclear data given here are used for neutron transport and related calculations. Evaluations of 79 nuclides/elements have been changed since the 1976 edition. DOE

N79-29021# Interagency Review Group on Nuclear Waste Management, Washington, D. C.
REPORT TO THE PRESIDENT BY THE INTERAGENCY REVIEW GROUP ON NUCLEAR WASTE MANAGEMENT
Mar. 1979 251 p refs
(TID-29442) Avail: NTIS HC A12/MF A01

Nuclear waste disposal and the future use of nuclear energy and the scope and magnitude of waste management are discussed. Emphasis is placed on national goals, planning objectives, criteria, and procedures for nuclear waste management to guide policy, planning, program, regulatory, and research and development activities. Technical strategies for high-level and transuranic wastes, low-level waste, uranium mill tailings, and waste generated by D&D activities are included. Institutional issues and management considerations including recommendations for follow-on implementation are covered. Work plans for each major type of waste, based on the goals, decisions, and interim strategic planning bases are given. J.M.S.

N79-29022# FMC Corp., Santa Clara, Calif. Engineered Systems Div.
DESIGN OF AN EQUIPMENT SYSTEM FOR RETRIEVAL AND HANDLING OF BURIED RADIOACTIVE WASTE Final Report
Jun. 1978 187 p refs
(Contract EY-76-C-07-1570)
(FMC-R-3679R) Avail: NTIS HC A09/MF A01

Preliminary design drawings of an equipment system for retrieval and handling of buried transuranic (TRU) waste are included. Descriptions of the operation, manpower requirements, safety and radiological aspects, cost, and other pertinent information are included. DOE

N79-29023# Department of Energy, Las Vegas, Nev. Operations Office.
SAFETY ASSESSMENT DOCUMENT FOR THE SPENT FUEL HANDLING AND PACKAGING PROGRAM DEMONSTRATION AT THE NEVADA TEST SITE
Dec. 1978 334 p refs
(NVO-198) Avail: NTIS HC A15/MF A01

Spent fuel assemblies from pressurized water and boiling water reactors will be received, encapsulated in leak tight steel canisters, and emplaced in E-MAD storage facilities. A thorough safety assessment of the demonstration activities to be conducted at the E-MAD facility was completed. It is concluded that (1) identifiable risks are no greater than those for a comparable licensed facility; (2) there are no undue risks to the health and safety of the public and employees; and (3) property and the environment are protected from identifiable undue risks. The site location and characteristics, the existing E-MAD facility, and the facility modifications and equipment additions made specifically for the program demonstration are described, the demonstration quality assurance program and the process steps to be performed are summarized, and the principal design criteria applicable to the facility modifications, equipment additions, and process operations are specified. DOE

N79-29024# Battelle Pacific Northwest Labs., Richland, Wash.
DEVELOPING ISOTOPIC FUNCTIONS
B. A. Napier and C. L. Timmerman Jun. 1978 15 p refs Presented at Symp. on Isotopic Correlation and its Appl. to the Nucl. Fuel Cycle, Stresa, Italy, 9 May 1978
(Contract EY-76-C-06-1830)
(PNL-SA-6594) Avail: NTIS HC A02/MF A01

Isotopic functions, or ratios of two isotopic variables, are used to verify Pu and U measurements of spent fuels in reprocessing plants. Systematic methods were developed for forming and evaluating isotopic functions. The method used at Battelle to form and evaluate isotopic functions is described. The data base at Battelle contains measurements and calculations for the fuel from 35 reactors. Author (DOE)

N79-29025# Stanford Linear Accelerator Center, Calif.
HADRON AND PHOTON PRODUCTION AT LARGE TRANSVERSE MOMENTUM AND THE DYNAMICS OF QCD JETS
S. J. Brodsky Oct. 1978 64 p Presented at the Symp. on Jets in High Energy Collisions, Copenhagen, 10 Jul. 1978
(Contract EY-76-C-03-0515)
(SLAC-PUB-2217; Conf-780781-1) Avail: NTIS

HC A04/MF A01

The phenomenology of hadron and photon reactions at short distances is discussed in terms of perturbative quantum chromodynamics. In addition to large P/sub T/hadron reactions, predictions are reviewed for jet production in two photon collisions, the relation of photon and gluon jet production, hadronic production and color separation, upsilon decay into hadrons and photons, leading particle distributions in low P/sub T/hadron collisions, discriminants of quark and gluon jets, and the effects of coherence on gluon distributions in hadrons. Some experimental tests of QCD are discussed. DOE

74 OPTICS

Includes light phenomena.

N79-29026 Rochester Univ., N. Y.
ANGULAR DISTRIBUTION OF AMPLIFIED SPONTANEOUS EMISSION: A COMPARISON OF THEORY AND LASER-PUMPED DYE AMPLIFIER EXPERIMENT Ph.D. Thesis
Philip Arthur Slaymaker 1979 179 p
Avail: Univ. Microfilms Order No. 7914504

Amplified spontaneous emission (ASE) is stimulated emission initiated by the fluorescence in a laser amplifier in the absence of optical feedback. A measurement of the angular distribution of ASE is shown to be a practical, sensitive, and unambiguous single-shot diagnostic of gain in laser amplifier experiments. A two-dimensional geometric model is presented that predicts the angular distribution of ASE from a rectangular amplifier with uniform fluorescence and gain. A transverse laser-pumped dye amplifier experiment is described which was designed to measure the ASE angular distribution from an optically freestanding amplifier with a nonuniform transverse gain profile. Measurements of the distribution are presented, and the observed dependence on the gain coefficient and the amplifier geometry compared to that predicted by the ASE theory. The model is extended to the case where only a portion of the emitting region exhibits gain. Dissert. Abstr.

N79-29027 Illinois Univ. at Urbana-Champaign.
FAR-INFRARED SUPERRADIANCE IN METHYL FLUORIDE Ph.D. Thesis
Albert Thomas Rosenberger 1979 178 p
Avail: Univ. Microfilms Order No. 7915417

Dicke superradiance, that is, cooperative spontaneous emission, was observed in methyl fluoride, which is optically pumped by a pulsed carbon dioxide TEA laser operated on the P(20) line at 9.55 microns. The far-infrared superradiant pulses, at a wavelength of 496 microns, were identified by the pressure dependence of their widths and delays (inversely proportional top) and their intensities. These pulses were observed by a fast, sensitive Si:P photoconductor calibrated to give absolute intensity, and were recorded for a range of pressures from .44 to .01 torr in each of several sample lengths from 168 to 1021 cm. This was done for emission in both the forward and the backward directions. A review of previous experiments and major theoretical work on superradiance is also given, with a consistent notation used throughout. The semiclassical theory is developed and several limiting cases are noted and solved. Dissert. Abstr.

N79-29028 Rochester Univ., N. Y.
PROPAGATION OF OPTICAL PULSES IN DISPERSIVE MEDIA Ph.D. Thesis
Kurt Edmund Oughstun 1978 284 p
Avail: Univ. Microfilms Order No. 7914492

Asymptotic techniques are applied to analyze the propagation of optical pulses through dispersive media which are linear, homogeneous, and isotropic with indices of refraction that vary with temporal frequency according to the Lorentz model. The optical pulses are plane waves that begin propagating as amplitude modulated signals with given carrier frequencies and modulation functions. Closed form analytic approximations that describe the dynamics of the pulses for sufficiently large values of the propagation distance Z for all time t are given. The results describe the dynamics of the precursors and the signal and show the effects introduced by the interaction of these fields. Results show that (1) the velocity of propagation of the signal does not peak to the vacuum speed of light for signal frequencies in the absorption band of the medium, as was obtained by Brillouin; (2) under certain conditions, the signal is broken up into two parts that are separated by Brillouin's precursor; and (3) there is a relationship between the velocity of propagation of the signal and the velocity of propagation of energy in a monochromatic field with the same frequency as the signal carrier frequency. Dissert. Abstr.

N79-29029 Rochester Univ., N. Y.
APODISATION OF COHERENT OPTICAL SYSTEMS Ph.D. Thesis
Matthew Eric Krisl 1979 320 p
Avail: Univ. Microfilms Order No. 7914476

The effect of finite apertures on the spatial invariance of several common coherent imaging systems is developed and it is shown that many of these systems exhibit spatially variant behavior which is aperture dependent. Configurations are suggested which produce spatially invariant performance for the systems considered and those results are generalized to apply to arbitrary imaging systems. Several apodisation functions suggested for use with coherent imaging systems are evaluated and compared as well as a photographic technique for the fabrication of apodisation filters. It is concluded that although the photographically produced filters have a low intensity damage threshold, they have an advantage in cost and versatility. Examples of apodisation filters produced are presented. Dissert. Abstr.

N79-29030 Rochester Univ., N. Y.
EXPERIMENTAL EXAMINATION OF DOUBLE OPTICAL RESONANCE Ph.D. Thesis
Howard Robert Gray 1979 179 p
Avail: Univ. Microfilms Order No. 7914467

The dynamics of the interaction between two monochromatic laser fields and three-level atomic energy systems were being studied by using two frequency stabilized CW dye lasers and a sodium atomic beam. The two systems studied in detail are: (1) the Cascade system, in which the atom undergoes two successive transitions from the ground state, through an intermediate state to a highly excited state, and (2) the Lambda system, in which the atom undergoes simultaneous transitions from the ground state and metastable sublevel of the ground state to the same excited state. The absorption spectra for these systems were measured and compared to the full quantum electrodynamic theory for these interactions. Dissert. Abstr.

N79-29031 Rochester Univ., N. Y.
COLOR DISCRIMINATION WITH ANNULAR-PUPIL IMAGING Ph.D. Thesis
Martin Ivan Greenfield 1979 204 p
Avail: Univ. Microfilms Order No. 7914468

The brightness and chromaticness of a stimulus is known to change with the position that the light enters the pupil. Color discrimination is therefore expected to be dependent on the size and the shape of the eye pupil. Color-matching experiments were performed to determine the change in color discrimination between circular and annular pupils in a variety of conditions. Annular-pupil imaging was investigated to determine whether this type of viewing situation, encountered when viewing through obscured-pupil reflecting optical systems, can significantly affect the color discrimination of visual stimuli examined through these instruments. Color matching of broad-band stimuli with highly eccentric pupil-entry was performed to determine the usefulness of empirical monochromatic Stiles-Crawford Effect of first kind and second kind data in predicting broad-band discrimination effects with highly eccentric pupil-entry. Dissert. Abstr.

N79-29032 Rochester Univ., N. Y.
A STUDY OF THE OPTICAL POLISHING PROCESS Ph.D. Thesis
James Joseph Bohache 1979 216 p
Avail: Univ. Microfilms Order No. 7914460

An investigation was conducted of the microscopic physical mechanisms for the polishing of glass with polyurethane polisher material. A computer analogue was developed which predicts the surface development for various microscopic mechanisms.

The active mechanism is determined by comparing the predictions of the analogue with the results of controlled polishing experiments. Due to the physical complexity of the polishing operation, emphasis was placed on simplification and standardization of technique in the experiments performed. Dissert. Abstr.

N79-29033 Rochester Univ., N. Y.
LOSS MECHANISMS IN OPTICAL INTERFERENCE DIELECTRIC COATINGS Ph.D. Thesis
Oded ArnonOhanna 1978 165 p
Avail: Univ. Microfilms Order No. 7914458

A theoretical and experimental analysis of optical dielectric multilayers and their loss mechanisms, due to absorption and scattering is presented. A unified model is developed to evaluate the losses of both mechanisms that are strongly dependent upon the internal electric field distribution. Analytical expressions are obtained for simple multilayer structures such as dielectric mirror, a stepped index antireflection coating and other designs that utilize one or more quarterwave stacks as a basic element. The theory can also be used to design coatings with enhanced resistance to laser damage via electric field breakdown. Merit functions are devised that predict a priori the magnitude of the losses and the relative damage threshold. A reflectometer and scatterometer were developed to measure the losses.
Dissert. Abstr.

N79-29034 Illinois Univ. at Chicago Circle, Chicago.
COUPLING THEORY FOR OPTICAL WAVEGUIDES AND OPTICAL FIBERS Ph.D. Thesis
Abdul-Ghaffar Kazkaz 1979 130 p
Avail: Univ. Microfilms Order No. 7916375

Controlling the coupling between optical waveguides is very important to their users. The coupling between rectangular waveguides and between optical fibers was studied. Both kinds are the most used in optical communication systems. The study included the design of an efficient coupler between optical fibers via an optical tube waveguide using the transverse coupling method. The conditions of maximum power transfer was found. It was proven that almost 100% transfer of power can be obtained. Most of all this theoretical thesis brings to light (quantitatively and by equations) the role of all the parameters involved in the design such as the refractive indices, the light wavelength, the dimension of the waveguides and the separation distance. This allows the users a wider choice of parameters and more flexible conditions. Dissert. Abstr.

N79-29035 Columbia Univ., New York.
THRESHOLD DETECTION IN OPTICAL COMMUNICATIONS AND PSYCHOPHYSICS Ph.D. Thesis
Paul Richard Prucnal 1979 135 p
Avail: Univ. Microfilms Order No. 7916440

Statistical properties such as the cumulants, and the central, factorial and ordinary moments, are obtained for photocounting distributions when the incident radiation is intensity modulated with arbitrary statistics. Comparison is made with experimental data in the cases of triangular and sinusoidal modulation of a laser source. It is shown that, when an arbitrary discrete process is embedded in independent, additive, discrete noise, the optimum likelihood-ratio processor reduces to a simple comparison of the number of events with a single threshold. Only a weak condition on the noise distribution is required. The results are extended to the cases of multiple independent observations of a signal embedded in noise, for the discrete and continuous cases. A generalized increment threshold law was obtained for arbitrary statistics, which describes the relationship between the just detectable average signal increment and the noise.
Dissert. Abstr.

N79-29036 California Univ., Berkeley.
MODE EXCITATION AND RADIATION IN OPTICAL FIBERS Ph.D. Thesis
John Paul Uyemura 1978 281 p
Avail: Univ. Microfilms Order No. 7914796

An examination of the processes of mode excitation in dielectric optical fibers is presented. In particular, the mathematical and physical unification of the primary types of modal fields which may exist on the fibers, namely, the guided, the radiation, and the leaky wave modes are considered. This consideration forms the basis of many fundamental practical problems, such as splicing and device coupling. In addition, much physical insight can be gained from such a study, which then leads to a better understanding of the field properties. Dissert. Abstr.

N79-29037* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RADIATION SHADOW INDICATOR Patent
Richard A. Campbell, inventor (to NASA) Issued 3 Jul. 1979 8 p Filed 31 Oct. 1978 Continuation of abandoned US Patent Appl. SN-778311, filed 16 Mar. 1977
(NASA-Case-MFS-23546-2; US-Patent-4,159,576; US-Patent-Appl-SN-956167; US-Patent-Class-33-281; US-Patent-Class-33-1H; US-Patent-Class-350-83) Avail: US Patent and Trademark Office CSCL 20F

A radiation shadow indicator having a slight tube for sighting shadow-casting objects along a sighting axis is described. The indicator includes a system of gimbals mounting the tube for angular movement so that the sighting axis thereof may be caused to follow the apparent diurnal movement of celestial objects at various seasons of the year. Position indicators are provided for instantaneous readout of angular positions of the gimbal device which, in turn, correspond to positions of the sighting axis at given seansons and/or times of day in relation to the location of the indicator on the surface of the earth.
Official Gazette of the U.S. Patent and Trademark Office

N79-29038# Auburn Univ., Ala. Dept. of Electrical Engineering.
INFRARED TARGET/BACKGROUND DISCRIMINATION-BACKGROUND SPECTRAL MODELING Final Technical Report, 1 Jun. 1977 - 30 Sep. 1978
L. J. Pinson and P. M. Goggans Nov. 1978 101 p
(Contract F33615-77-C-1188; AF Proj. 7633)
(AD-A068152; AFAL-TR-78-176) Avail: NTIS HC A06/MF A01 CSCL 17/5

This report discusses the development of statistical models for signals in the background radiance distribution. Techniques for analyzing multispectral line scan data are developed and demonstrated on background data obtained by the Environmental Research Institute of Michigan. Since the scope of the data is not adequate to provide statistically significant results, the conclusions are restricted to a presentation of the analytic method and a discussion of its potential applicability to more realistic data. GRA

N79-29039# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ELECTROOPTICAL DEVICES Semiannual Technical Summary Report, 1 Apr. - 30 Sep. 1978
Charles E. Hurwitz 30 Sep. 1978 36 p refs
(Contract F19628-78-C-0002; AF Proj. 2611)
(AD-A069091; ESD-TR-78-394) Avail: NTIS HC A03/MF A01 CSCL 20/5

The current objectives of the electrooptical device program are: to perform life tests on GaInAsP/InP double-heterostructure (DH) diode lasers operating in the 1.0- to 1.3-micrometers-wavelength region and analyze the degradation mechanisms, and to fabricate and study avalanche photodiodes of similar composition GaInAsP operating in the same wavelength region. Threshold current densities in DH GaInAsP/InP stripe geometry lasers have been reduced to 2 to 3 KA/sq cm, which, together with new mounting procedures designed to reduce thermal resistance, have resulted in improved performance at elevated temperatures. Considerably lengthened lifetimes and meaningful accelerated aging studies at temperatures as high as 70 C should now be possible. Improved p-n junction diodes have been formed by Be-implantation in n-type InP and GaInAsP. Subnanoampere leakage currents and abrupt voltage breakdowns were observed for both mesa and planar InP diodes. Scanning photoresponse measurements of the GaInAsP (E sub g approx. = 1.0 eV) mesa diodes showed uniform avalanche gains of 2 to 3 times.
GRA

N79-29040# McDonnell Aircraft Co., St. Louis, Mo.
INFRARED NON-LINEAR LENS Final Report, Oct. 1977 - Aug. 1978
Ralph W. Fisher, Roger D. Helmick, and Richard A. Kupferer Dec. 1978 97 p refs

(Contract F33615-77-C-1113; AF Proj. 2004)
(AD-A068594; AFAL-TR-78-204) Avail: NTIS HC A05/MF A01 CSCL 17/5

A dynamic target acquisition analytic model for a Variable Acuity Remote Viewing System (VARVS) was developed and experimentally verified. The model was then used to compute target acquistion capability of an infrared version of the VARVS and conventional linear FLIR's with various fields of view. Results indicated that the VARVS, as presently configured, has a target acquisition effectiveness of about 80% of the best linear sensor. The study indicated VARVS performance could be improved by broadening the high acuity central portion of the distortion function or by reducing slew time. However, it never exceeds the performance of the linear sensor with the proper field of view. While it can be concluded that the VARVS concept offers no improvement over conventional linear sensor, the limitations of the theory and experiment must be recognized. They represent acquisition of a fixed target from a stable platform. If the vehicle is maneuvering or if cues such as motion or glints exist, the wide field of the VARVS may play an important role in supporting the cognitive factors that are little understood in target acquisition. Secondary objectives were to determine the feasibility of a common aperture narrow field high resolution capability for the sensor. The design effort could not achieve the required performance over the 2 degree narrow field of view. However, no technical constraints could be identified which make such a design not feasible. Author (GRA)

N79-29041# Wisconsin Univ. - Madison. Mathematics Research Center.
SELF-FOCUSSED AND SELF-TRAPPED BEAMS IN NONLINEAR OPTICS Technical Summary Report
Mohamed N. Y. Anwar and Robert D. Small Jan. 1979 19 p refs
(Contract DAAG29-75-C-0024)
(AD-A068938; MRC-TSR-1917) Avail: NTIS HC A02/MF A01 CSCL 20/6

Self-focussing and self-trapping of light rays are studied in a classical two-dimensional nonlinear model both in the geometrical optics approximation and when retaining higher dispersion terms. The paraxial ray approximation of Akhmanov that leads to the nonlinear Schrodinger equation is specifically avoided. It is found that in the geometrical optics approximation, focussing must eventually occur once convergence of rays begins. When both diffraction and nonlinearity are present, however, focussing may or may not occur. GRA

N79-29042# Research Inst. of National Defence, Stockholm (Sweden).
A METHOD OF DETERMINING SMALL SHIFTS IN X-RAY REFLECTIONS DETECTED BY PARALLEL SCANNING [EN METHOD FOER BESTAEMNING AV SMAA FOERSKJUTNINGAR AV ROENTGENREFLEXER UPPTAGNA GENOMPARRALLELLAVSOEKNING]
Eva Elvers, Mats Larsson (Roy. Inst. of Technol., Stockholm), and Rolf Soederqvist May 1978 24 p In SWEDISH
(FOA-C-20241-E2(E3)) Avail: NTIS HC A02/MF A01

The reflection for a reference material is recorded by a position-sensitive sensor and is stored in a multichannel analyzer. The reflection from the material under investigation is subtracted from the stored reflection. Changes in the appearance of the reflection are then calculated from difference curves. Changes in position are determined to an accuracy of approximately the square root of t/A, where t is the width of the reflection and A is the pulse count at the peak. A typical measuring time is about 2 min. The method is illustrated by experiments using test rods of aluminium and carbon-fiber reinforced laminated plastic. A.R.H.

N79-29043# National Bureau of Standards, Boulder, Colo. Electromagnetic Technology Div.
LASER BEAM PROFILE MEASUREMENTS USING SPATIAL SAMPLING, FOURIER OPTICS, AND HOLOGRAPHY
Eric G. Johnson Jan. 1979 96 p refs
(PB-293491/7; NBS-TN-1009) Avail: NTIS HC A05/MF A01 CSCL 20F

A technique for beam profile measurements at a preselected observation plane was demonstrated, using appropriate holography, lenses, mirrors, and two-dimensional array of small holes to sample the electric field of a laser pulse. This method can measure the amplitude and phase of a laser pulse at each preselected sampling point on a transverse observation plane. Subject to constraints, these measurements can provide separated visual images of the temporal pulse shapes for the amplitude and phase at each of the sampled electric fields. The basic concepts for beam profile measurements via holography are described, and pictures generated by a prototype system for illustration are used. GRA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N79-29044 California Univ., Los Angeles.
SOME SAFETY ASPECTS OF TOKAMAK-TYPE FUSION POWER REACTORS Ph.D. Thesis
Walter Lee Ferrell 1979 138 p
Avail: Univ. Microfilms Order No. 7915658

In investigating the safety of Tokamak-type fusion reactors, two areas of concern are analyzed: firstly, the nonlinear behavior of the plasma under density-temperature instabilities; and secondly, an unprotected blanket loss-of-coolant-accident (LOCA). The plasma behavior is analyzed using a single species, point kinetics model, and the LOCA is analyzed using neutronic analysis, a magnetohydrodynamic (MHL) flow model, and a thermal hydraulic model. An analytical approach based on Comparison Methods is developed and is used to study the plasma, assuming three different diffusion constant models: (1) constant time diffusion; (2) Bohm diffusion; and (3) classical diffusion. Dissert. Abstr.

N79-29045 Illinois Univ. at Urbana-Champaign.
PERIODIC FLUID TRANSIENTS IN MAGNETOHYDRODYNAMIC DUCT FLOW Ph.D. Thesis
Robert Bruce Myers 1979 65 p
Avail: Univ. Microfilms Order No. 7915401

Propagating-wave solutions are sought for the flow of a compressible, electrically conducting fluid contained in a rigid duct which is placed in an externally-applied, uniform transverse magnetic field. An equation governing the transport of magnetic flux is derived, and asymptotic limits are derived based on the relative importance of terms in the equation. It is found that there are three regimes of wave motion, characterized by the relative values of the Mach number, and the magnetic Reynolds number. Solutions for circular, rectangular, and highly conducting rectangular ducts are discussed. Dissert. Abstr.

N79-29046 California Univ., Berkeley.
AXIAL FEEDBACK STABILIZATION OF THE FLUTE INSTABILITY IN MIRROR PLASMAS Ph.D. Thesis
Sik-Lam Wong 1978 90 p
Avail: Univ. Microfilms Order No. 7914816

The flute mode in a mirror-confined plasma is stabilized by modifying the line-typing admittance between the bulk of the plasma and the end wall with feedback. By feeding back a voltage proportional to the time integral of the potential perturbation, stabilization is obtained for individual modes. The axial feedback concept is extended to two other feedback schemes: proportional feedback, and proportional-and-derivative feedback. The integral feedback scheme is used to stabilize the $p=1$ flute mode in a seven cell multiple mirror plasma. A systems analysis of the experimental set-up is performed and a coupled-mode feedback theory is developed for the experimental system. There is good qualitative agreement between experiment and theory. Phase shifts due to mode coupling are observed. By using a mode fiber in the feedback loop to reduce mode coupling, a reduction in phase shift as well as an expansion in the stabilization region are observed, in agreement with the coupled mode theory. Dissert. Abstr.

N79-29047# Nagoya Univ. (Japan). Inst. of Plasma Physics.
SPECIAL CYLINDRICAL EQUILIBRIA OF A COMPRESSING

FLUX-CONSERVING TOKAMAK
K. Yamazaki May 1979 16 p refs
(IPPJ-391) Avail: NTIS HC A02/MF A01

Evolution of a Tokamak equilibrium with adiabatic compression and rapid beam heating is analyzed using a cylindrical flux-conserving model. The time-dependent relation between the plasma Beta and the pressure profile is obtained, which is necessary to avoid the increase of the longitudinal field at the plasma surface or the expansion of the plasma column due to rapid beam heating. As for three-dimensional adiabatic compression the current peaking of the order of Beta appears on the compressing frame, while two-dimensional compression does not lead to the change of profiles. Author

N79-29048# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ELECTROMAGNETIC INSTABILITY AND STOPPING POWER OF PLASMA FOR RELATIVISTIC ELECTRON BEAMS
T. Okada and K. Niu May 1979 18 p refs
(IPPJ-390) Avail: NTIS HC A02/MF A01

The stopping power of a plasma for a relativistic electron beam (REB) is derived by taking a Weibel-type electromagnetic instability into account in a collisionless plasma. A quasi-linear theory is developed to derive the stopping power of the plasma due to the electromagnetic instability. The wave-particle interaction by use of the renormalization theory leads to a saturation level of instability. Thus the purely growing electromagnetic instability including the effect of the beam temperature decides an effective stopping length of the REB in the plasma. Author

N79-29049# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ANISOTROPIC EQUILIBRIA OF A HIGH-BETA TOKAMAK WITH NON-CIRCULAR CROSS-SECTION
K. Yamazaki and T. Uchida May 1979 13 p refs
(IPPJ-393) Avail: NTIS HC A02/MF A01

The characteristics of the high-Beta Tokamak equilibrium with noncircular cross-section and anisotropic pressure are studied analytically. The equilibrium Beta sub p limit defined by effective pressure (p parallel + p perpendicular)/2 does not depend on pressure anisotropy, however toroidal mass flow leads to the reduction of the critical Beta sub p value of the noncircular Tokamak. Author

N79-29050# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ELECTRON TEMPERATURE EFFECTS FOR AN ION BEAM SOURCE
Joshin Uramoto May 1979 34 p refs
(IPPJ-395) Avail: NTIS HC A03/MF A01

A hydrogen high temperature plasma up to 200 eV is produced by acceleration of electrons in a hot hollow cathode discharge and is used as an ion beam source. Two characteristics are observed: a rate of the atomic ion number increases above 70 percent; and a perveance of the ion beam increases above 30 times compared with that of a cold plasma, while a floating potential of an ion acceleration electrode approaches an ion acceleration potential (- 500 V) according as an increment of the electron temperature. Moreover, a neutralized ion beam can be produced by only the negative floating electrode without an external power supply. Author

N79-29051# Nagoya Univ. (Japan). Inst. of Plasma Physics.
TRENDS OF PLASMA PHYSICS AND NUCLEAR FUSION RESEARCH LIFE CYCLE AND RESEARCH EFFORT CURVE
Takeru Ohe, Yasumasa Kanada, Hiromu Mamota, and Yoshi H. Ichikawa May 1979 36 p refs
(IPPJ-396) Avail: NTIS HC A03/MF A01

A quantitative analysis of research trends in the fields of plasma physics and nuclear fusion is presented. The analysis is based on information retrieval from available data bases. The results indicate that plasma physics research is now in the maturation phase of its life cycle, and that nuclear fusion research is in its growth phase. It was found that there is a correlation between the number of accumulated papers in the fields of plasma physics and nuclear fusion and the experimentally attained values of the plasma ignition parameter ntT. Using this correlation research effort curve, it is forecast that the scientific feasibility of controlled fusion using magnetic confinement systems will be proved around 1983. G.Y.

N79-29052# Nagoya Univ. (Japan). Inst. of Plasma Physics.
EFFECTIVE TOROIDAL CURVATURE AND ERROR FIELD ON NBT
H. Iguchi, M. Hosokawa, T. Shoji, M. Fujiwara, and H. Ikegami Apr. 1979 19 p refs
(IPPJ-385) Avail: NTIS HC A02/MF A01

The effective toroidal curvature and the poloidal drift velocity for transit electrons with V sub double prime/v = 1 are measured for NBT-I device by use of an electron beam probing. The axis of the drift surfaces shifts inward by 12 cm due to the toroidal effect. The error field averaged along the torus is found to be spatially varying and <Delta B/B> is 0.0011 at the minor axis. Author

N79-29053# Nagoya Univ. (Japan). Inst. of Plasma Physics.
INITIAL FREQUENCY SHIFT OF LARGE AMPLITUDE PLASMA WAVE (LANGMUIR WAVE)
Ryo Sugihara and Kaoru Yamanaka Apr. 1979 23 p refs
(IPPJ-387) Avail: NTIS HC A02/MF A01

A distribution function which is a solution to the collisionless Boltzmann equation is obtained in an expansion form in terms of the potential phi (x, t). A complex nonlinear frequency shift omega sub N (t) is obtained by use of the Poisson equation and the expansion. The theory reproduces main features of experimental results and that of simulations. M.M.M.

N79-29054# Nagoya Univ. (Japan). Inst. of Plasma Physics.
EXPERIMENTS ON THE SCATTERING OF ION ACOUSTIC SOLITONS AND TURBULENCE FORMATION
Yasushi Nishida (Utsunomiya Univ., Japan) May 1979 50 p refs Presented at Joint USA-Japan Seminar on Self-Organizing Flows and Vortex Motions in Plasma, Kyoto, 8-13 Jan. 1979
(IPPJ-388) Avail: NTIS HC A03/MF A01

A precise measurement on the cylindrical ion acoustic soliton is performed in a coaxial DP-type plasma device. The experimental results of the velocity variation on the amplitude, and on the radial position are in good agreement with the numerical simulation based on the modified Boussinesq or the K-dV equations. The spatial width of a soliton pulse is wider than the predicted value and shows the larger value than the one-dimensional case. The scattering of solitons is observed after the collapse of cylindrical ion acoustic soliton at the plasma center. This is discussed as the resonance type scattering, and the conservations of energy and momentum are confirmed. The multiple soliton formations observed before the collapse are in good agreement with the theoretical prediction. Author

N79-29055# Naval Postgraduate School, Monterey, Calif.
SELF GENERATED MAGNETIC FIELDS IN LASER-PRODUCED SHOCK WAVES M.S. Thesis
Cem Yildirim Parlar Dec. 1978 108 p refs
(AD-A067695) Avail: NTIS HC A06/MF A01 CSCL 20/9

The generation of spontaneous magnetic fields in a plasma produced by a 5.0 Joule, 22 nanosecond laser pulse and the generation of the reversed magnetic fields after several hundred nanoseconds due to the interaction between the laser produced plasma and a background plasma was investigated. The generation of the reversed magnetic fields coincides with the steepening of the expanding plasma front. This steepening is caused by a collisional shock wave which is formed during the interaction of the expanding laser-produced plasma with the photoionized background gas. The analysis of the source term for magnetic field production indicates that the generation of the reverse fields is due to an axial temperature gradient and a radial density gradient. This axial temperture gradient is a result of the heating of the plasma in the collisional shock wave. The width of the shock was measured to be 0.2 cm. The magnitude of the maximum reverse field was measured at 5.0 Torr (H2) background pressure to be 150 Gauss. Author (GRA)

N79-29056# Naval Research Lab., Washington, D. C.
NRL INERTIAL CONFINEMENT FUSION THEORY PROGRAM 1978 Annual Interim Report, Oct. 1977 - Sep. 1978
26 Feb. 1979 111 p refs
(AD-A068470; AD-E000293; NRL-MR-3944) Avail: NTIS HC A06/MF A01 CSCL 20/7

This annual report of the NRL Inertial Confinement Fusion

Theory Program covers research performed in each of the following five current program areas: (A) Transport of Charged Particle Beams; (B) Laser and Particle Beam Absorption; (C) Fluid Dynamics and Ablative Acceleration; (D) Development of Computational Techniques; and (E) Rayleigh-Taylor Stabilization Techniques. GRA

N79-29057# Naval Research Lab., Washington, D. C.
BEAM-PLASMA HEATING MODEL CODE AND COMMENTARY
Kent A. Gerber 8 May 1979 20 p refs
(AD-A069105; NRL-MR-3995) Avail: NTIS HC A02/MF A01 CSCL 20/9

A computer code listing, definition of terms, and CSN step commentary are presented as a supplement to the paper 'Beam-Plasma Heating Model', by D. A. Hammer, A. W. Ali and myself. Together, these papers should allow application of our heating code to a wide and varied range of beam and plasma parameters and resistivity models. GRA

N79-29058# Artec Associates, Inc., Hayward, Calif.
SHOCK PHYSICS OF NONIDEAL PLASMAS Final Report, 15 Mar. 1978 - 14 Apr. 1979
Dennis W. Baum, W. Lee Shimmin, Robert F. Flagg, Stephen P. Gill, and D. Mukherjee Apr. 1979 64 p refs
(Contract N00014-78-C-0354)
(AD-A068873; AR-130) Avail: NTIS HC A04/MF A01 CSCL 20/9

This study is an experimental investigation of nonideal plasmas produced by strong shock waves. The study centered about the understanding of factors controlling the specific energy and transport properties of dense plasma in an explosively energized plasma source. The study addressed specifically the gas cavity geometry, pressure-density effects, radial velocity effects, and size scaling. Both argon and xenon were used for the working gas. Shock speeds ranged from 25.9 to 32.5 km/sec, and measured gas conductivities of 10 to 50 kilosiemens/meter were obtained. The highest peak field amplification in the four shot series was 19 dB. GRA

N79-29059# California Univ., Livermore. Lawrence Livermore Lab.
PLASMA GUN PROPOSAL
T. C. Simonen 18 Aug. 1978 265 p refs
(Contract W-7405-eng-48)
(LLL-1569) Avail: NTIS HC A12/MF A01

A experimental method for start-up of a field-reversed mirror plasma is described. Engineering descriptions are given of the plasma gun, capacitor banks, DC guide field, experiment control, and diagnostics. Six papers are also included as appendices on field reversed mirrors. DOE

N79-29060# Department of Energy, Washington, D. C. Office of Fusion Energy.
STEADY-STATE CURRENT DRIVE IN TOKAMAKS WORKSHOP SUMMARY
Feb. 1979 107 p refs
(DOE/ET-0077) Avail: NTIS HC A06/MF A01

The most promising techniques were identified and the expectations for Tokamak reactor concepts were outlined by the group which included beam and rf specialists who prepared specific recommendations for the establishment of a program directed at demonstrating current drive. The recommendations and conclusions provided by A. Bers, D. Jassby, and T. Hsu, and the summary papers submitted by the participants describing the various experiments and studies presented at the workshop are presented. DOE

N79-29061# Sandia Labs., Albuquerque, N. Mex.
NUMERICAL CODES FOR MHD FLOWS Quarterly Technical Progress Report
Frederick G. Blottner, Anthony J. Russo, John G. Taylor, and G. Ronald Hadley Feb. 1979 23 p refs
(Contract EY-76-C-04-0789)
(SAND-78-1954) Avail: NTIS HC A02/MF A01

Numerical techniques and codes for characterizing coal combustion-operated MHD generators and diffusers were developed. The work called for four tasks: (1) development of a one-dimensional channel code; (2) development of multidimensional channel codes; (3) conduct slag layer studies and heat transfer analyses; and (4) study arc formation, migration, and electrode erosion. A summary of the current progress on these tasks is presented. DOE

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N79-29062 Purdue Univ., Lafayette, Ind.
APPLICATION OF AVERAGING TO SPONTANEOUS RADIATION PROCESSES FOR ONE-AND TWO-ATOM SYSTEMS, PART ONE. A THEORETICAL INVESTIGATION OF VIBRATIONAL ENERGY RELAXATION IN SOLIDS, PART TWO Ph.D. Thesis
Harold Douglas Ladouceur 1978 147 p
Avail: Univ. Microfilms Order No. 7914921

In an effort of place the Wigner-Weisskopf approximation on a firm mathematical basis, the time-dependent Schrodinger equation for the fundamental problem of the radiative linewidth is solved by an approximation method for systems of integro-differential equations known as averaging. This method yields simply and rigorously the Dirac zeta function, which is vital to a proper description of the radiative damping of an atom. Moreover, the technique is readily extended to an N-atom system. In particular, the coherence effect brought about by the presence of a second atom is examined by averaging. A quantum mechanical model which accounts for the dynamical participation of orientational motions in vibrational energy relaxation of diatomic impurities isolated in raregas solids is developed. Dissert. Abstr.

N79-29063 North Carolina Univ. at Chapel Hill.
A NUCLEAR MAGNETIC RESONANCE STUDY USING A MULTIPLE PULSE SPIN-LOCKING TECHNIQUE ON CALCIUM FLUORIDE DOPED WITH TRIVALENT IMPURITIES Ph.D. Thesis
James Theodore Compton 1978 131 p
Avail: Univ. Microfilms Order No. 7914331

The spin-lattice relaxation time in the rotating frame, T sub 1 rho for temperatures from 300 K to 90 K was measured using the NMR resonance of F19 in single crystals of CaF2. Both the Hartmann-Hahn spin-lock technique and a multiple pulse spin-lock technique were used. The multiple pulse technique had distinct advantages over the Hartmann-Hahn sequence. The expected angular orientation dependence of T sub 1 rho for a number of defect motions was calculated and compared to experimental results obtained for the .01 mol% and .1 mol% yttrium doped samples. The minimum in T sub 1 rho at 203 K is attributed to a center consisting of a single Y(3+) with double fluoride compensation. One hundredth mol% Y(3+) doped sample of BaF2 was used to obtain T sub 1 rho over the same temperature range. An activation energy of 0.08 ev was assigned to one component of the relaxation observed. Dissert. Abstr.

N79-29064 California Univ., Berkeley.
LIGHT SCATTERING STUDIES OF SOLIDS AND ATOMIC VAPORS Ph.D. Thesis
Tai-Chang Chiang 1978 129 p
Avail: Univ. Microfilms Order No. 7914566

The technique of light scattering and luminescence to study the properties of a number of material systems was used. Multi-phonon resonant Raman scattering up to four phonons in GaSe and one-and two-phonon resonant Raman scattering in the mixed GaSxSe1-x crystals are investigated. The observation of one-phonon resonant Raman scattering in HfS2 is reported. The first observation of the pi -polarized one magnon luminescence sideband of the 4T sub 1g (4G) = 6A sub 1g (6S) excited transition in antiferromagnetic MnF2 is presented. The first observation of two-magnon resonant Raman scattering in MnF2 around the magnon sidebands is reported as well as a theory of exciton-exciton interaction in MnF2 to explain and to predict the experimental results on two-exciton absorption, high level excitation, and exciton-exciton scattering. Brillouin scattering is

used to obtain the five independent elastic constants of the layered compound GaSe. The results show clear elastic anisotropy of the crystal. Two-photon parametric scattering in sodium vapor is studied. Dissert. Abstr.

N79-29065 Carnegie-Mellon Univ., Pittsburgh, Pa.
DEEP IMPURITY STUDIES IN SILICON Ph.D. Thesis
Jun-Wei Chen 1979 376 p
Avail: Univ. Microfilms Order No. 7916174

Studies are described of iron, titanium, platinum and gadolinium in silicon with respect to energy levels, capture cross sections, emission coefficients in junction depletion regions and minority carrier-diffusion lengths. A review is also presented of other impurities in silicon and native and radiation defects and some new patterns of behavior established. Dissert. Abstr.

N79-29066 California Univ., Berkeley.
SUPERCONDUCTING TRANSITION EDGE BOLOMETER AND NOISE IN THIN FILMS Ph.D. Thesis
Nan-Hsiung Yeh 1978 110 p
Avail: Univ. Microfilms Order No. 7914823

The development of the composite superconducting transition edge bolometer is reported. The temperature sensitive element is an aluminum strip evaporated onto the sapphite substrate. A bismuth film evaporated on the reverse side of the substrate is used to absorb the submillimeter radiation. The noise limitation of the bolometer is calculated. The fabrication and measured performance are described. Dissert. Abstr.

N79-29067 State Univ. of New York at Stony Brook.
ANGLE RESOLVED PHOTOEMISSION STUDIES OF Ag(111) AND Cu(111): EXPERIMENT AND THEORY Ph.D. Thesis
David Scott Liebowitz 1979 132 p
Avail: Univ. Microfilms Order No. 7914446

Angle resolved ultraviolet photoemission spectra were obtained from clean surfaces of Cu(111) and Ag(111) crystals with unpolarized and polarized light at photon energies of 11.6, 16.9, 21.2, 26.9 and 40.8 eV. The experimental spectra were compared with the results predicted by various models of photoemission. The one-dimensional density of states model was found to fail to predict the positions of the peaks in the photoemission spectra, while the free electron final state model was found to predict the positions of the peaks fairly well, but not their intensities. A new model based upon a final state resembling an augmented plane wave describes the positions, intensities, and shapes of peaks in the photoemission spectra at low photon energies for arbitrary polarizations of the incident light and directions of emission. Dissert. Abstr.

N79-29068 Rochester Univ., N. Y.
THE GROUND STATE PROPERTIES OF THE ANDERSON LATTICE SYSTEM, CeAl2 Ph.D. Thesis
Lenn Carl Kupferberg 1979 107 p
Avail: Univ. Microfilms Order No. 7914477

The results of a number of experiments which attempt to elucidate the unusual low temperature properties of CeAl2 are presented. At 3.85K the system enters an antiferromagnetic phase in which the magnitudes as well as the directions of the magnetic moments exhibit spatial periodicity. This is believed to result from the close proximity of the 4f electrons of Ce to the fermi level and the concomitant hybridization between the 4f and conduction electrons, this being a characteristic and refining feature of so-called Anderson lattice systems. By measuring magnetostriction and thermal expansion in single crystals the evolution of the magnetic order in applied magnetic field is elucidated. The observation of a broad peak in the magnetoresistance around 20kOe is discussed. Preliminary results of neutron diffraction studies on single crystals of CeAl2 are reported.
Dissert. Abstr.

N79-29069 North Carolina Univ. at Chapel Hill.
A MEASUREMENT OF THE PRESSURE DEPENDENCE OF THE MOESSBAUER ISOMER SHIFT AND RECOILLESS FRACTION OF CRYSTALLINE ANTIMONY Ph.D. Thesis
William Tompkins Krakow 1978 121 p
Avail: Univ. Microfilms Order No. 7914375

The pressure dependence of the Mossbauer isomer shift in crystalline Sb was measured for pressures up to 25 kbars. The measured shift is 0.0029 plus or minus 0.0003 mm sec/1/kbar/1. Several theoretical predictions are made for the pressure dependence of the contact charge density. These predictions are used along with the measured change in isomer shift with pressure to determine a value for theisomer shift calibration constant for sb. The pressure dependence of the recoilless fraction is measured for Sb. The zero pressure recoilless fraction is measured to be 0.318 plus or minus 0.009 at 77 K. The pressure dependence of the recoilless fraction is found to be 0.0018 plus or minus 0.0003/kbar at 77 K. The increase of recoilless fraction with pressure corresponds to an increase in the Debye temperature with pressure in Sb. Dissert. Abstr.

N79-29070 Rochester Univ., N. Y.
SUPERCONDUCTIVITY IN NbGe2 AND ISOSTRUCTURAL C-40 COMPOUNDS Ph.D. Thesis
Christina Marie Knoedler 1979 116 p
Avail: Univ. Microfilms Order No. 7914481

The high transition temperatures (T sub c = 16K) exhibited by sputtered films of NbGe2 are shown to be an intrinsic property of the compound and are attributed to the degree of order produced during the formation process. It is also shown that different sample preparation techniques lead to different values of the superconducting transition temperature, illustrating with a higher degree of order produced in the system. The role of excess germanium and thermal effects are also discussed for NbGe2. A study of the binary compounds of the hexagonal C-40 system consisting of the members of CrSi2, VSi2, NbGe2, NbSi2, TaGe2, TaSi2, and HfSn2 shows that four members exhibit superconductivity. Those that showed superconductivity were NbGe2 (T sub c = 16K), NbSi2 (T sub c = 2.9K), TaSi2 (T sub c = 4.4K), and TaGe2 (T sub c = 2.7K). Dissert. Abstr.

N79-29071 California Univ., Berkeley.
ELECTRONIC STATES OF ADSORBATES, CLEAN SOLID SURFACES AND BULK A-15 COMPOUNDS Ph.D. Thesis
Kai-Ming Ho 1978 206 p
Avail: Univ. Microfilms Order No. 7914638

A self-consistent pseudopotential technique is used to study various surface systems. Calculated results are compared with photoemission experiments. Electronic states associated with the presence of steps on surfaces are investigated by considering a model structure of the Si(111) surface containing steps. A method to the problems of hydrogen and chlorine chemisorption on the Si(111) surface was then applied. Using a non-local ionic pseudopotential. The method was extended to calculate the electronic structure of bulk Nb and the ideal Nb(001) surface. A mixed basis approach was developed to allow more efficient calculation of electronic structures of transition metal surfaces and compounds. Using the mixed basis pseudopotential technique, realistic self-consistent calculations of the electronic structure of high temperature superconducting A-15 compounds Nb3Ge and Nb3Al were performed. Dissert. Abstr.

N79-29072 Columbia Univ., New York.
HIGH-TEMPERATURE SERIES EXPANSIONS FOR THE FREE ENERGY OF s EQUALS ONE HALF HEISENBERG MODEL ON A SIMPLE SQUARE LATTICE Ph.D. Thesis
Purushottam Das Gujrati 1979 126 p
Avail: Univ. Microfilms Order No. 7916413

The free energy for spin 1/2 Heisenberg Model on a simple square lattice is expanded in terms of Beta=J/kT, and is expressed in terms of the contributions of finite clusters according to the finite cluster method. Two distinct methods of calculating the contributions of the finite clusters are developed. The matrix method is suited for calculating the partition function Z sub L prime (H) of small clusters of class A, most of which have n less than or equal to 10. The cycle method is used for the remaining clusters of classes B and C. For clusters in class B, the T(L), from which the partition function Z sub L prime (H) is calculated, is determined. For clusters in class C, the related quantity V(L) is calculated. Finally, it should be remarked that throughout the computation, only integers are involved.
Dissert. Abstr.

N79-29073 Rutgers - The State Univ., New Brunswick, N. J.
PERCOLATION PROBLEMS AND DILUTE MAGNETIC SYSTEMS Ph.D. Thesis

Mylar Ramachandra Giri 1979 90 p
Avail: Univ. Microfilms Order No. 7916138

The bond and site percolation models were formulated as the limit of spin models and spin Hamiltonians were obtained for these models. The order parameters in each case provide generating functions for the site and bond distributions in the clusters. The form of the site-bond distributions is discussed. It is shown that the critical behavior of both models is characterized by the same critical exponents. These models are shown to be the zero temperature limits of dilute Ising models with random bond and random site occupation. The behavior of these models of dilute magnetic systems at low temperatures near the percolation threshold is discussed. The fixed points corresponding to the different transitions are located and critical exponents are calculated near six dimensions. Dissert. Abstr.

N79-29074 Illinois Univ. at Urbana-Champaign.
APPLICATION OF RENORMALIZATION-GROUP TECHNIQUES TO RANDOM MAGNETIC SYSTEMS Ph.D. Thesis
Ciriyam Jayaprakash 1979 122 p
Avail: Univ. Microfilms Order No. 7915369

Second-order phase transitions in pure, homogeneous systems and the renormalization group framework are reviewed. Quenched random magnetic systems are introduced and momentum-space methods and position-space techniques as applied to quenched random magnets are outlined and compared. The randomly bond-dilute two-dimensional nearest-neighbor Ising model on a square lattice is studied. Calculations give both thermal and magnetic exponents associated with the percolative fixed point. Differential recursion relations yield a phase diagram which is in quantitative agreement with all known results. Curves for the specific heat, percolation probability, and magnetization are displayed. The Edwards-Anderson model of a spin glass is examined as well as the spin-1/2 Ising model with independently random nearest-neighbor interactions in dimensionalities d = 2, 3, and 4. Dissert. Abstr.

N79-29075 Rochester Univ., N. Y.
A FUNDAMENTAL STUDY OF THE MIXING OF SOLID PARTICLES Ph.D. Thesis
Dilid Kumar Singh 1979 145 p
Avail: Univ. Microfilms Order No. 7914503

The mixing of solid particles in a rotating, horizontal cylinder is considered. The analysis of the system is simplified by selectively studying the surface phase with special attention to axial diffusion in the cylinder. The movement of particles in the surface phase can be described by the two-dimensional Boltzmann equation superimposed with source-sink, or birth-and-death terms. Moments of the Boltzmann equation yield macroscopic balance equations for the surface phase. The transport coefficients in terms of diffusive kinetic energy and number density were postulated. The mechanisms of particle movement on the free surface is assumed to be frictionless. Dissert. Abstr.

N79-29076 California Univ., Berkeley.
ELLIPSOMETRY OF ANODIC FILM GROWTH Ph.D. Thesis
Craig Gordon Smith 1978 359 p
Avail: Univ. Microfilms Order No. 7914767

An automated computer interpretation of ellipsometer measurements of anodic film growth was developed. Continuous mass and charge balances are used to utilize more fully the time-dependence of the ellipsometer data and the current and potential measurements. A multiple-film model is used to characterize the growth of films which proceeds via a disolution-precipitation mechanism; the model also applied to film growth by adsorption and nucleation mechanisms. The characteristic parameters describe homogeneous and heterogeneous crystallization rates, film porosities and degree of hydration, and the supersaturation of ionic species in the electrolyte. An automatic, self-compensating ellipsometer was used to study the growth in alkaline solution of anodic films on silver, cadmium, and zinc. Dissert. Abstr.

N79-29077 Purdue Univ., Lafayette, Ind.
DISCLINATIONS IN A LAMELLAR LIQUID CRYSTAL Ph.D. Thesis
James Ehrhardt Zimmer 1978 172 p
Avail: Univ. Microfilms Order No. 7914990

The configurations of the disclinations in lamellar liquid crystals were determined from curvature-elasticity theory. Curvatures are defined for the lamellar liquid crystal and its free-energy density is defined as a quadratic function of these curvatures. The solutions to the equations that define the conditions of minimized free energy yield the configurations of the disclinations. Scanning electron micrography was employed successfully to observe the wedge disclinations that are prominent in the lamellar liquid crystal known as the carbonaceous mesophase, which is the critical phase that determines the microstructure of industrial cokes and graphites. This micrography was facilitated by the use of microconstituents of the carbonaceous mesophase with unique geometries and an ion-etching technique. The core structures of the wedge disclinations were also delineated and the twist disclinations in this lamellar liquid crystal were observed. Dissert. Abstr.

N79-29078# Harvard Univ., Cambridge, Mass. Div. of Applied Sciences.
IMPURITY EFFECTS IN AMORPHOUS SEMICONDUCTORS Final Report, 1 Jan. 1977 - 31 Dec. 1978
W. Paul 1 Mar. 1979 18 p refs
(Grants DAAG29-77-G-0059; NSF DMR-76-01111)
(AD-A067599; ARO-14454.1-P; FR-1) Avail: NTIS HC A02/MF A01 CSCL 20/12

This research is directed toward the discovery of the preparation conditions and material properties which will yield amorphous silicon-hydrogen alloys with the lowest density of defect-related states in the energy gap and/or the best photo-response. Among the effects investigated were the results of varying the substrate temperature and the partial pressures of hydrogen, argon and oxygen in the sputter-gas mixture. It was established that too high a substrate temperature (say, greater than 300 C) led to the incorporation of less hydrogen and to a larger gap state density. It was also established that films containing the same concentration of hydrogen, but prepared under different conditions of hydrogen partial pressure, showed different behavior as regards transport, photo transport, photoluminescence and absorption. These data were explained in terms of different state densities in the energy gap. Variation of the argon partial pressure was shown to give films of different conductivity and photoconductivity, and an argument was made that there was an optimum argon pressure: the critical argon pressure corresponded to that which was sufficient to reduce the mean free path of the sputtered silicon below the interelectrode separation. Author (GRA)

N79-29079# Rutgers - The State Univ., Piscataway, N. J.
PIEZOELECTRIC ACTIVITY AND FIELD-INDUCED CRYSTAL STRUCTURE TRANSITIONS IN POLED POLY(VINYLIDENE FLUORIDE) FILMS Interim Report
B. A. Newman, C. H. Yoon, K. D. Pae, and J. I. Scheinbeim 1 Apr. 1979 30 p refs Submitted for publication
(Contract N00014-75-C-0540)
(AD-A068114; TR-15) Avail: NTIS HC A03/MF A01 CSCL 20/2

Unoriented and biaxially oriented phase II poly(vinylidene fluoride) films were poled at very high fields up to 4 million V/cm at room temperature. Changes in molecular orientation and crystal structure induced by the high-field poling were studied using X-ray and D.S.C. methods. The piezoelectric coefficients d and e together with the dielectric response were determined using a Piezotron Model U (Toyo Seiki, Tokyo, Japan) for the poled films. GRA

N79-29080# IBM Watson Research Center, Yorktown Heights, N.Y.
THEORETICAL STUDIES OF DEFECTS IN TETRAHEDRAL SEMICONDUCTORS Final Report, 1 Oct. 1976 - 30 Sep. 1978
S. T. Pantelides and J. A. VanVechten 30 Nov. 1978 58 p refs
(Contract F49620-77-C-0005)
(AD-A068728; AFOSR-79-0598TR) Avail: NTIS HC A04/MF A01 CSCL 20/2

This is the final report on work that has been carried out

on the electronic and thermochemical properties of impurities, point defects and dislocations in semiconductors. Author (GRA)

N79-29081# Brookhaven National Lab., Upton, N. Y.
MEASUREMENTS OF IMPURITY MIGRATION IN GRAPHITE AT HIGH TEMPERATURES USING A PROTON MICROPROBE
R. E. Shroy, P. Soo, C. A. Sastre, D. G. Schweiter, H. W. Kraner, and K. W. Jones 1978 4 p refs Presented at the 5th Inter-Am. Conf. on Mater. Technol., Sao Paulo, Brazil, 6 - 8 Nov. 1978
(Contract EY-76-C-02-0016)
(BNL-25191; Conf-7811113-18) Avail: NTIS HC A02/MF A01

Work was carried out in which graphite specimens were heated to temperatures up to 3800 C to induce migration of trace elements whose local concentrations are then measured with a proton microprobe. This instrument is a powerful device for such work because of its ability to determine concentrations at a part per million (ppm) level in a circular area as small as 10 micrometers while operating in an air environment. Studies show that Si, Ca, Cl, and Fe impurities in graphite migrate from hotter to cooler regions. Also Si, S, Cl, Ca, Fe, Mn, and Cr are observed to escape from the graphite and be deposited on cooler surfaces. DOE

N79-29082# Desert Research Inst., Reno, Nev.
STUDIES OF NUCLEATION AND GROWTH OF HYDRATE CRYSTALS WITH APPLICATION TO THERMAL STORAGE SYSTEMS Final Report
L. Christensen, G. Keyser, E. Wedum, N. Cho, D. Lamb, and J. Hallett Feb. 1979 16 p refs
(Contract W-7405-eng-26; Grant NSF AER-75-19601)
(NSF/RANN/AER-75-19601) Avail: NTIS HC A02/MF A01

Crystallization of a one and two component system for thermal storage by fusion heat of salt hydrates has been investigated for sodium sulfate (10H2O), sodium thiosulfate (5H2O) and sodium acetate (3H2O). A continuous input of small crystals which grew and sedimented from the solution aimed to keep heat transfer surfaces crystal free. The two component system utilized kerosene as the heat transfer fluid. The operating characteristics and thermal efficiency of these systems were investigated for two pilot units, and optimum operating conditions for constant power output are delineated. Studies were made of solution nucleation, secondary crystal production, linear crystal growth velocity, habit and solution viscosity, refractive index and density within the operating range of concentrations to be used in a storage system, for both supersaturated and undersaturated solutions. DOE

N79-29083# Ames Lab., Iowa.
INTERACTION OF AMMONIA WITH SINGLE CRYSTAL RHODIUM CATALYSTS, 1. HYDROGEN AND NITROGEN ADSORPTION ON A W(III) SURFACE: A THEORETICAL MOLECULAR ORBITAL APPROACH, 2 Ph.D. Thesis
A. Vavere Jan. 1979 166 p refs
(Contract W-7405-eng-82)
(IS-T-849) Avail: NTIS HC A08/MF A01

Rates of ammonia decomposition on (110), (100), and (111) single crystal faces of rhodium were measured at 580 to 725 K and 0.001 to 0.5 torr. The decomposition rates were proportional to P/sub NH3/sup/1/2/ and P/sub NH3/ at low and high hydrogen pressures, respectively. The H2 kinetic order varied from 0 (low P/sub H2/) to -1.0 (high P/sub H/). A rate expression was derived from a model involving surface species Rh2Nh, RhH, and RhN on a nearly bare RH surface. The preferred site for both H and N chemisorption was determined as the TOP position, i.e., a single coordinate site on top of a protruding W atom. DOE

N79-29084# Ames Lab., Iowa.
DETERMINATION OF BOND ENERGIES BY MASS SPECTROMETRY. SOME TRANSITION METAL CARBONYLS Ph.D. Thesis
G. D. Michels Jan. 1979 257 p refs
(Contract W-7405-eng-82)
(IS-T-837) Avail: NTIS HC A12/MF A01

Two groups of transition metal carbonyls were studied, M(CO)6 and M(CO)5CS complexes of the Group VIB metals and M2(CO)10 complexes of the Group VIIB metals. Least squares dissociation energies calculated from corrected data for M(CO)5CS complexes indicated that the M-CS bond is three to four times stronger than the M-CO bonds. Substitution of CS for CO in going from M(CO)6 to M(CO)5CS weakens the remaining M-CO bonds. Previous unreported MnTc(CO)10 and TcRe(CO)10 were prepared by halide substitution of Tc(CO)5Br and Re(CO)5Br with Mn(CO)5(-) and Tc(CO)5(-), respectively. In the positive ion, metal and mixed-metal decarbonyls are considered as (CO)5M(+)-M (CO)5 complexes possessing five strong and five weak M-CO bonds. For Mn2(CO)10 and Re2(CO)10, M(+)-M dissociation energies were 3.0 + -0.1 and 4.0 + -0.3 eV, respectively. These energies are 2.5 times greater than those reported for homolytic cleavage to M(CO)5(+) and M(CO)5. DOE

N79-29085# Sandia Labs., Albuquerque, N. Mex.
DIFFUSION OF HYDROGEN AND ITS ISOTOPES IN BCC METALS
D. Emin, M. I. Baskes, and W. D. Wilson 1979 9 p refs Presented at the Hydrogen in Metals Intern. Meeting, Munster, W. Ger., 6 Mar. 1979
(Contract EY-76-C-04-0789)
(SAND-78-1427; Conf-790301-7) Avail: NTIS HC A02/MF A01

The diffusion constant for models of the interatomic interatomic interactions associated with an interstitial in a metal were calculated. With this procedure the conditions under which quantum-mechanical tunneling is the predominant mode of light interstitial transport in metals was investigated. In situtations characterized by interstitial tunneling motion the validity of simplifying assumptions of the formal theory were examined. There are examples of light interstitial diffusion which do not correspond to tunneling through a barrier. In those instances where tunneling motion does prevail, the influence of excited states of the interstitial wells, the breakdown of the Condon approximation, and the predominance of adiabatic hopping qualitatively affect the hopping rate. The magnitudes, temperature dependences and isotope dependences of the calculated diffusion constants are consistent with existing diffusion data on bcc metals. DOE

N79-29086# California Univ., Berkeley. Lawrence Berkeley Lab.
ELECTRONIC STRUCTURE OF f-BLOCK COMPOUNDS
Norman M. Edelstein Aug. 1978 45 p refs Presented at the Organometallics of the f-elements, Sogesto, Italy, 11 Sep. 1978
(Contract W-7405-eng-48)
(LBL-8058; Conf-7809127-2) Avail: NTIS HC A03/MF A01

The electronic structure of an f/sup n/ ion is dominated by interactions different from those for the more familiar d-transition ions. The methods and nomenclature used to describe the electronic structure of f/sup n/ compounds are reviewed under the following topics: brief review of atomic theory; ligand field and spin-orbit Hamiltonians for f1; the electrostatic and spin-orbit Hamiltonians for f2; results of tensor operator methods; ligand field effects for the f2; configuration-uranocene; general method for calculating crystal field matrix elements for f/sup n/ configuration; electron paramagnetic resonance. Author (DOE)

N79-29087# Sandia Labs., Albuquerque, N. Mex.
PROTON LOCATION IN METAL HYDRIDES USING ELECTRON SPIN RESONANCE
E. L. Venturini 1979 20 p refs Presented at Workshop on Analysis of Hydrogen in Solids, Albuquerque, N. Mex., 23 Jan. 1979
(Contract EY-76-C-04-0789)
(SAND-79-0244C; Conf-790127-5) Avail: NTIS HC A02/MF A01

Electron spin resonance (ESR) of dilute paramagnetic ions establishes the site symmetry of these ions. In the case of metal hydrides the site symmetry is determined by the number and location of neighboring protons. Typical ESR spectra for trivalent erbium in scandium and yttrium hydrides are presented and analyzed, and this technique is shown to be a versatile microscopic probe of the location, net charge and occupation probability of nearby protons. DOE

N79-29088# Harvard Univ., Cambridge, Mass.
RECENT RESULTS ON THE DRIFTING OF ELECTRONS IN LIQUID ARGON
W. Huffman, J. LoSecco, and C. Rubbia Apr. 1978 15 p refs
(Contract EY-76-C-02-3064)
(COO-3004-013) Avail: NTIS HC A02/MF A01

A high resolution large mass detector was proposed for the next generation of counter neutrino experiments. The concept and details of an electronic imaging chamber employing liquid argon were put forward. Such a detector measures the time of arrival and pulse size of the electron cloud produced by ionizing tracks in argon, at an (x,y) array on the wall of the chamber. The pulse size can be used for particle identification. The liquid argon time projection chamber could conceivably give spatial resolutions on the order of millimeters over drift distances of 0.5 meters or more. Crucial to the implementation of these ideas is the behavior of electrons drifting large distances in the liquid. Small amounts of impurities could cause significant attenuation of the signal. DOE

N79-29089# Bendix Corp., Kansas City, Mo.
THICK FILM BONDING
G. A. Swartz Feb. 1979 37 p refs Revised Sponsored by DOE
(BDX-613-2090-Rev) Avail: NTIS HC A03/MF A01

The project was undertaken to determine the characteristics of thick film conductors that affect thermocompression bonding. Thick film inks were analyzed to determine compositional characteristics that could be used as acceptance criteria. Analytical methods evaluated included thermogravimetric analysis, pyrolysis gas chromatography, infrared spectrophotometry, mass spectrometry, atomic absorption spectrophotometry, scanning electron microscopy with energy dispersive X-ray spectroscopy, and an electronics counter. The effects of bonding force and substrate temperature versus bond strength were evaluated for three thick film conductor materials. DOE

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N79-29090 Pennsylvania State Univ., University Park.
A VAN LAAR TYPE MODEL FOR VAPOR-LIQUID EQUILIBRIA PREDICTION Ph.D. Thesis
Chung-Tong Lin 1979 173 p
Avail: Univ. Microfilms Order No. 7915720

In predicting vapor-liquid equilibrium (VLE), many expressions were developed and applied to correlate activity coefficients. However, there is no equation available to directly estimate activity coefficients from the most widely used properties of pure components such as the critical temperature, critical pressure, and acentric factor. An attempt was made to develop such a correlation. The van Laar equations correlate well with the activity coefficients of nonpolar hydrocarbon mixtures. In addition, the constants are predictable from the critical properties of the constituents of the mixture through the constants of an equation of state. Therefore, the van Laar model was adopted as a model for study in this work. A one-parameter van Laar type expression, which relates the activity coefficient of a component to its critical properties, was developed and applied to correlate activity coefficients. Dissert. Abstr.

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N79-29091 Ohio State Univ., Columbus.
CONSIDERATIONS IN THE DESIGN OF PERFORMANCE MEASUREMENT SYSTEMS FOR INDEPENDENT RESEARCH ORGANIZATIONS Ph.D. Thesis
Joseph West Ray 1979 177 p
Avail: Univ. Microfilms Order No. 7916018

Relationships between performance measurement and performance were investigated to identify and develop considerations relevant to the design of business performance measurement systems (PMS) for independent research organizations. The research was based on a model which postulated two links between performance measurement and performance: a behavioral link involving organizational climate as an intervening variable, and a technical link reflecting the use of performance measurements as the basis for business decisions which in turn affect organizational performance. Dissert. Abstr.

N79-29092# National Science Foundation, Washington, D. C. Div. of Science Resources Studies.
NATIONAL PATTERNS OF R AND D. RESOURCES: FUNDS AND PERSONNEL IN THE UNITED STATES, 1953-1978-1979
Oct. 1978 56 p refs
(PB-293847/0; NSF-78-313) Avail: NTIS HC A04/MF A01 CSCL 05A

Data are presented on the dollar volume of research and development performed within each sector of the economy; sources of financing; number of R and D Scientists and engineers; international comparisons; and other economic characteristics of the nation's R and D effort. GRA

N79-29093# National Science Foundation, Washington, D. C. Government Studies Group.
AN ANALYSIS OF FEDERAL R AND D FUNDING BY FUNCTION, FISCAL YEARS 1969 - 1979 Final Report, 1969 - 1979
Dec. 1978 80 p refs
(PB-293880/1; NSF-78-320) Avail: NTIS HC A05/MF A01 CSCL 05A

A total of 439 programs and program areas are identified and classified within the function structure by the primary purpose of the program. The absolute and relative amounts directed to each area are shown, and the current distribution is compared with earlier distributions to show changes in priorities. The chief function areas in the 1979 budget were national defense, space, health, and energy development and conversion. The first three of these were the leading functions throughout the 1969-79 period. The areas scheduled for chief growth in the 1979 budget were defense and space. The other areas taken together showed only 3-percent growth. The report includes the effects of later congressional appropriation actions, which resulted in increases in health, energy, and food and slight reductions for defense and space. GRA

N79-29094# General Accounting Office, Washington, D. C. Community and Economic Development Div.
NATIONAL BUREAU OF STANDARDS: INFORMATION AND OBSERVATIONS ON ITS ADMINISTRATION
21 Mar. 1979 80 p
(PB-293747/2; CED-79-29) Avail: NTIS HC A05/MF A01 CSCL 05A

Information and observations on more important aspects of

how the National Bureau of Standards is administered are provided. It also explains some complexities of a major scientific organization. The Senate Committee on Commerce, Science and Transportation and its Subcommittee on Science, Technology and Space were concerned about persistent reports of a decline in the Bureau's scientific capabilities and its ability to adequately respond to specific congressional assignments. The committees saw the need for a critical review of the bureau's organic act and for possibly updating this statute in light of the Bureau's evolving role as a national laboratory. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N79-29095 University of Southwestern Louisiana, Lafayette.
A METHODOLOGY FOR THE INFERENTIAL DERIVATION OF RETRIEVAL SEMANTICS UTILIZING A RELATIONAL VIEW OF A META-BASE Ph.D. Thesis
Thomas Richard Cousins 1978 164 p
Avail: Univ. Microfilms Order No. 7915003

A methodology through which noncomputer professionals may interact directly with an information system for specification, interpretation and resolution of their information needs is addressed. Specific topics addressed are: (1) the structure, content, and applicability of an auxiliary data base (the meta-base) as an underlying support mechanism and the basis of a methodology; and (2) the detection and use of semantic and structural interrelationships (access paths) within a user's target data base. Also described is the design, implementation and evaluation of an information retrieval system which employs the meta-base centered design methodology. The resultant system includes a partial implementation of the theoretical access paths. Dissert. Abstr.

N79-29096 Kansas State Univ., Manhattan.
GENERALIZED DISTRIBUTED INFORMATION MANAGEMENT ARCHITECTURE (GDIMA) Ph.D. Thesis
Jacob Slonim 1978 323 p
Avail: Univ. Microfilms Order No. 7915194

Contemporary information systems are examined and what features in these systems are essential and common to all information systems, and which features are accidental and arise only from the peculiarities of mechanical environments are deterimined. The essential function is isolated and each is discretely defined at the highest possible level of abstraction. A general equation set for any hierarchical decomposition of the generalized distribution information management architecture is provided. Considerable attention is devoted to the weakest unit in all information systems, the Input/Output area. Concurrency of processing is a concern. The throughput of the distributed architecture is projected against the throughput of a centralized, sequential processor, using the same queries and data base under identical conditions. Criteria are established by which it is possible to balance improvements in response time against cost benefits at various levels of concurrency. Dissert. Abstr.

N79-29097 California Inst. of Tech., Pasadena.
CARTAM: THE CARTESIAN ACCESS METHOD FOR DATA STRUCTURES WITH N-DIMENSIONAL KEYS Ph.D. Thesis
Stephen Petersen 1979 196 p
Avail: Univ. Microfilms Order No. 7915594

The Cartesian Access Method (CARTAM) is a data structure and its attendant access program is designed to provide rapid retrievals from a data file based upon multidimensional keys: for example, using earth surface points defined by latitude and longitude, retrieve all points within x nautical miles. The data structure and program are described in detail and the actual routines as implemented on the International Business Machine (IBM) System/370 series of computers are provided. The search technique is analogous to the binary search for a linear sorted file and seems to run in O(log(N)) time. An indication of the performance is the extraction, in less than 25 milliseconds CPU time on an IBM 370, Model 3033, of all points within a 10,000-foot circle from a geographic data base containing approximately 100,000 basic records. Dissert. Abstr.

N79-29098 Purdue Univ., Lafayette, Ind.
INCORPORATION OF DATABASE SYSTEMS CONCEPTS INTO SIMULATION MODELING Ph.D. Thesis
Charles Robert Standridge 1978 254 p
Avail: Univ. Microfilms Order No. 7914977

A database system tailored for use in simulation modeling, SIMDABS, was designed and implemented in the FORTRAN computer programming language. This system is a tool for use by simulation modelers in the organization, storage and retrieval of all data concerning a simulation study. Furthermore, SIMDABS provides simulators a framework in which to develop simulation models. Data dependent, complex logic may be more easily implemented within simulation computer programs. Commands which allow the simulators to reorganize, analyze and then retrieve data within these programs are provided. Dissert. Abstr.

N79-29099 Purdue Univ., Lafayette, Ind.
DYNAMIC CLUSTERING TECHNIQUES FOR PHYSICAL DATABASE DESIGN Ph.D. Thesis
Jo-Mei Chang 1978 219 p
Avail: Univ. Microfilms Order No. 7914882

The problem of performing multiple attribute clustering in a dynamic database is studied. The extended K-d tree method is presented. In an extended K-d tree organization, the basic K-d tree structure after modification is used as the structure of the directory which organizes the data records in the secondary storage. The implementation of the extended K-d tree storage structure and its basic access methods of a DEC PDP 11/70 using the UNIX operating system are described. The design of the discriminator function is described. A heuristic approach to the problem of directory attribute selection is proposed. The comparison of the performance of the extended K-d tree method and existing multiple attribute retrieval methods are presented. Dissert. Abstr.

N79-29100# Naval Ship Research and Development Center, Bethesda, Md.
GIRS (GRAPH INFORMATION RETRIEVAL SYSTEM) USERS MANUAL
Irving S. Zaritsky Apr. 1979 194 p refs
(AD-A068204; DTNSRDC-79-036) Avail: NTIS HC A09/MF A01 CSCL 09/2

The Graph Information Retrieval System (GIRS) provides a convenient and efficient technique for the insertion, retrieval, modification, and deletion of data in a data base. This technique is based on a scheme of representing the various data items as nodes and establishing the relationships between the nodes by linking them together into node-link-node triples which are assembled into a graph that can be stored on disk. GIRS is made up of 15 FORTRAN subroutines. It has been implemented on the CDC 6700, the PDP 11/45, and the UNIVAC 1108 computing systems, and can easily be adapted to other machines having FORTRAN IV compilers. The implementation and use of GIRS are described. GRA

N79-29101# Defense Documentation Center, Alexandria, Va.
DDC RETRIEVAL AND INDEXING TERMINOLOGY POSTING TERMS WITH HIERARCHY AND KWOC, 2D EDITION
May 1979 377 p refs Supersedes DDCH-4185.7-Vol-1; DDCH-4185.7-Vol-2
(AD-A068500; DDCH-4185.7; DDCH-4185.7-Vol-1; DDCH-4185.7-Vol-2) Avail: NTIS HC A17/MF A01 CSCL 05/2

This Second Edition of the DDC Retrieval and Indexing Terminology (DRIT) displays DDC's controlled Posting Term vocabulary. This vocabulary, supplemented by DDC-assigned identifiers and open-ended terms is used to index DDC's scientific and technical literature. It has been revised to exclude some 250,000 natural language Use References which are presently undergoing extensive revision. DDC's indexing and retrieval vocabulary is displayed in three ways: an alphabetical section of Posting Terms together with Broader and Narrower Terms

when they exist; a hierarchical display which shows the family of Posting Terms with their generic/specific relationships to the extent that they exist within the DDC data banks; and a Keyword Out of Context (KWOC) listing of the Posting Terms which provides an alphabetical entry to the vocabulary on an individual word basis independently of the location of the word in a Posting Term. This publication provides a basic multidisciplinary subject term vocabulary to be used not only by DDC to index and retrieve information from its various data banks but also as an aid to assist DDC's users in their information storage and retrieval operations. GRA

N79-29102# Harvard Univ., Cambridge, Mass. Center on Decision and Conflict in Complex Organizations.
TEAMS WITH VARIABLE PRECISION INFORMATION STRUCTURES: A MODEL FOR ORGANIZATION FORM
Nicholas M. Papadopoulos Mar. 1979 13 p refs
(Contract N00014-77-C-0533)
(AD-A068725; TR-4) Avail: NTIS HC A02/MF A01 CSCL 12/1

Motivated by considerations of optimal organizational form for a firm, a model is constructed that describes an organization as a team each of whose members has access to the same basic information seen through noisy channels. The amounts of noise on the channels are the control parameters of the problem and serve to characterize the organization. The chief advantages of this model are easier calculation of the optimal information structure--organizational form, and an easy way of characterizing bounded rationality by constraining the minimum amount of total noise that a decision maker must accept on his information. For analytic expediency, a general Linear-Quadratic-Gaussian model is constructed and solved for two special cases. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N79-29103# Texas Univ. at Austin. Center for Cybernetic Studies.
TRANSFORMS AND APPROXIMATIONS IN COST AND PRODUCTION FUNCTION RELATIONS
A. Charnes, W. W. Cooper, and A. P. Schinnar Mar. 1979 25 p refs
(Contracts N00014-75-C-0616; N00014-75-C-0569; N00014-75-C-0932; Grant NSF SOC-76-15876)
(AD-A068993; CCS-339) Avail: NTIS HC A02/MF A01 CSCL 05/3

Process analysis and related approaches to the study of energy economics have made extensive use of Shephard's lemma as well as other aspects of the Shephard-Samuelson transformation theories. A major problem is shown to be present in the use of these transforms to go from cost functions to production possibility sets in that the latter will always be unbounded above. Capacity conditions, which are especially important in energy policy studies, are therefore not adequately addressed. Troubles also occur in the use of translog approximations because of the functional forms which can result when the Shephard-Samuelson transformations are employed. Nondiffferentiability is not the primary difficulty with the translog approximations as is shown with an infinitely differentiable function. Relations between other parts of mathematical transform theory, e.g. as exhibited in Laplace transforms, are also indicated along with possible extensions that might be made in the Shephard-Samuelson 'duality' theories. GRA

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N79-29104# Committee of Conference (U. S. Congress).
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AUTHORIZATION ACT, FISCAL YEAR 1980
Washington GPO 1979 9 p Conference rept. to accompany H.R. 1786 from the Comm. of Conference, 96th Congr., 1st Sess., 20 Jul. 1979
(H-Rept-96-371; GPO-39-006) Avail: US Congress, House Document Room

The committee of conference on the disagreeing votes of the two Houses on the amendment of the Senate to the bill (H.R. 1786) to authorize appropriations to the National Aeronautics and Space Administration for research and development, construction of facilities, and research and program management, and for other purposes, agreed to recommend that the House recede from its disagreement to the amendment of the Senate and agree to the same with an amendment. An amendment insert is presented which lists NASA programs and their funding allocations to be appropriated and made available October 1, 1979. G.Y.

N79-29105# Committee on Science and Technology (U. S. House).
NASA AUTHORIZATION, 1980, VOLUME 1, PART 2
Washington GPO 1979 427 p refs Hearing on H.R. 1786 before the Comm. on Sci. and Technol., 96th Congr., 1st Sess., 6 Feb. 1979
(GPO-46-134) Avail: Comm. on Sci. and Technol.

The President's budget for NASA is reviewed in the light of his civilian space policy and its impact on NASA programs. Major activities of FY 1980 highlighted include the space transportation system, space sciences, space and terrestrial applications, aeronautics and space technology, space tracking and data systems, construction of facilities, research and program management, and international programs. The budget request is considered to comprise a sound, balanced aeronautics and space program, given the constraints of the national anti-inflational effort. It supports the continued development of the space transportation system, meets commitments made in the past, maintains progress in ongoing programs, and provides for flexibility in future programs. A.R.H.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N79-29106*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HYDROGEN-FUELED POSTAL VEHICLE PERFORMANCE EVALUATION
R. A. Hall 15 Jun. 1979 28 p Prepared for NASA, DOE, and US Postal Service
(Contract NAS7-100)
(NASA-CR-158811; JPL-PUB-79-55) Avail: NTIS HC A03/MF A01 CSCL 13F

Fuel consumption, range, and emissions data were obtained while operating a hydrogen-fueled postal delivery vehicle over a defined Postal Service Driving Cycle and the 1975 Urban Driving Cycle. The vehicle's fuel consumption was 0.366 pounds of hydrogen per mile over the postal driving cycle and 0.22 pounds of hydrogen per mile over the urban driving cycle. These data correspond to 6.2 and 10.6 mpg equivalent gasoline mileage for the two driving cycles, respectively. The vehicle's range was 24.2 miles while being operated on the postal driving cycle. Vehicle emissions were measured over the urban driving cycle. HC and CO emissions were quite low, as would be expected. The oxides of nitrogen were found to be 4.86 gm/mi, a value which is well above the current Federal and California standards. Vehicle limitations discussed include excessive engine flashbacks, inadequate acceleration capability the engine air/fuel ratio, the water injection systems, and the cab temperature. Other concerns are safety considerations, iron-titanium hydride observed in the

fuel system, evidence of water in the engine rocker cover, and the vehicle maintenance required during the evaluation. A.R.H.

N79-28107*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AERODYNAMIC CHARACTERISTICS OF SIXTEEN ELECTRIC, HYBRID, AND SUBCOMPACT VEHICLES
Donald W. Kurtz 30 Jun. 1979 96 p refs Prepared for NASA and DOE
(Contract NAS7-100)
(NASA-CR-158814; JPL-PUB-79-59) Avail: NTIS HC A05/MF A01 CSCL 13F

An elementary electric and hybrid vehicle aerodynamic data base was developed using data obtained on sixteen electric, hybrid, and sub-compact production vehicles tested in the Lockheed-Georgia low-speed wind tunnel. Zero-yaw drag coefficients ranged from a high of 0.58 for a boxey delivery van and an open roadster to a low of about 0.34 for a current four-passenger proto-type automobile which was designed with aerodynamics as an integrated parameter. Vehicles were tested at yaw angles up to 40 degrees and a wing weighting analysis is presented which yields a vehicle's effective drag coefficient as a function of wing velocity and driving cycle. Other parameters investigated included the effects of windows open and closed, radiators open and sealed, and pop-up headlights. Complete six-component force and moment data are presented in both tabular and graphical formats. Only limited commentary is offered since, by its very nature, a data base should consist of unrefined reference material. A justification for pursuing efficient aerodynamic design of EHVs is presented. A.R.H.

N79-29108*# National Aeronautics and Space Administration, Washington, D. C.
SPINOFF 1979 Annual Report
James J. Haggerty Feb. 1979 118 p Original contains color illustrations
(NASA-TM-80481) Avail: NTIS MF A01; SOD HC $4.25 CSCL 05A

NASA's current mainline programs which are producing public benefit through direct application of technology and, at the same time, are generating new technology which may find secondary application in the future are summarized. A representative sampling of spinoff products and processes derived from NASA technology and employed in various avenues of everyday life is included. The mechanisms of the technology transfer process, including the means by which NASA seeks to stimulate technology utilization are described as well as NASA's activities in assisting agencies interested in exploiting the benefit potential of satellite remote sensing technology. A.R.H.

N79-29109# Committee on Government Operations (U. S. House).
HAZARDOUS MATERIALS ACCIDENT REPORTING
Washington GPO 1978 405 p refs Hearing before a Subcom. of the Comm. on Government Operations, 95th Congr., 2d Sess., 25 Apr. 1978
(GPO-31-268) Avail: Comm. on Government Operations

The merits of recommendations made by the National Transportation Safety Board in 1976 to reduce the number of casualties among firefighters and other response personnel during a hazardous materials transportation accident are evaluated. Services and systems currently used to provide information transfer and assistance for on-the-scene handling of inadvertent spills of volatile, toxic, gaseous, and/or flammable materials shipped in bulk are described. Methods for protecting the public and for preventing water pollution are also examined. A.R.H.

N79-29110*# Mechanical Technology, Inc., Latham, N. Y.
CONCEPTUAL DESIGN STUDY OF AN AUTOMOTIVE STIRLING REFERENCE ENGINE SYSTEM
Jun. 1979 31 p Prepared for NASA and DOE
(Contracts DEN3-32; EC-77-A-31-10040)
(NASA-CR-159605; MTI-79ASE53RE1A; DOE/NASA/0032-79/1) Avail: NTIS HC A03/MF A01 CSCL 13F

The studies that were made, the methodology that was used, and the results which support the concluded recommendation of a four cylinder, double acting, square 'U' design, with external regenerators are described. Optimization of this design concept resulted in a calculated fuel economy of 36.3 mpg for a 3200 pound vehicle, compared to the program goal of 30.0 mpg., and acceleration time of 13.1 seconds compared to the program goal of 15.0 seconds. The engine will meet or exceed the program emission goals of HC < 0.41 gram/mile, CO < 3.4 gram/mile, and nitrogen oxide < 0.4 gram/mile. A.R.H.

N79-29111# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
STATE OF KNOWLEDGE IN LAND TREATMENT OF WASTEWATER, VOLUME 2
H. L. McKim 25 Aug. 1978 405 p refs International Symp. held at Hanover, New Hampshire, 20-25 Aug. 1978
(AD-A067886; CRREL-MP-1145-Vol-2) Avail: NTIS HC A18/MF A01 CSCL 13/2

Ongoing research is reported in the following areas: site selection; design criteria; agriculture and forest management; health considerations; and monitoring procedures. Case studies, cost estimates, and mathematical modelling are also considered. A.R.H.

N79-29112# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
STATE OF KNOWLEDGE IN LAND TREATMENT OF WASTEWATER, VOLUME 1
H. L. McKim Aug. 1978 427 p refs International Symp. held at Hanover, New Hampshire, 20-25 Aug. 1978
(AD-A067885; CRREL-MP-1145-Vol-1) Avail: NTIS HC A19/MF A01 CSCL 13/2

The objectives of this international symposium were to summarize the state of knowledge of the practical aspects of the treatment of wastewater by land application and to identify the suitable approaches for the design of such land treatment systems. Topics included in the proceedings volumes are: site selection considerations, case studies of national and international concern, health effects of land treatment systems, pretreatment considerations, uses of wastewater in agricultural and forest systems, monitoring, modeling and design criteria. Volume 1 contains 46 invited papers (presented and discussed) and Volume 2 contains 53 papers (not presented) on ongoing research. Author (GRA)

N79-29113# Sandia Labs., Albuquerque, N. Mex.
TRANSPORTATION TECHNICAL ENVIRONMENTAL INFORMATION CENTER INDEX
C. A. Davidson and J. T. Foley Jan. 1979 53 p
(Contract EY-76-C-04-0789)
(SAND-75-0248D) Avail: NTIS HC A04/MF A01

In an effort to determine the environmental intensities to which energy materials in transit may be exposed, a data center of technical environmental information was established. An index is presented which can be used to request data of interest. DOE

N79-29114# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ELECTRIC/HYBRID VEHICLE SIMULATION PROGRAM (ELVEC) USER'S MANUAL
Jul. 1978 114 p
(Contract EM-78-I-01-4209)
(HCP/M-4209) Avail: NTIS HC A06/MF A01

The user's manual provides the user with enough information to allow him to use the program which resides on National CSS Timeshare. Detailed information is conveyed by the use of several simulation examples and an explanation of the results of these examples (on a line-by-line basis) as required. Except for a brief description of the road load equations, this user's manual does not include descriptions of the math models. DOE

N79-29115# Oak Ridge National Lab., Tenn.
ENERGY INTENSITY AND RELATED PARAMETERS OF SELECTED TRANSPORTATION MODES: PASSENGER MOVEMENTS
A. B. Rose Jan. 1979 177 p refs
(Contract W-7405-eng-26)
(ORNL-5506) Avail: NTIS HC A09/MF A01

A study was undertaken aimed at determining the causes of the divergences among published energy-intensity values and at preparing a set of consistent values. The findings in relation to the passenger-transportation modes are presented. After a brief overview of the important factors to be considered and

the potential pitfalls facing users and analysts of energy-intensity values, a chapter is devoted to each of the major means of passenger transportation: air, automobile, bus, and rail. In each of these chapters, after a critique of the available data sources, a consistent time series of operational data and energy-intensity values is presented for the major sectors of each mode. Engineering simulations and data analysis are also carried out. Matrices giving the great-circle distances and modal-circuity ratios among the 50 largest standard metropolitan statistical areas are included. DOE

N79-29116# California Univ., Livermore. Lawrence Livermore Lab.
PRELIMINARY DESIGN ANALYSIS OF THE QUASI-ELECTRIC DRIVE VEHICLE
M. W. Schwartz and E. Lorbeer Dec. 1978 31 p refs
(Contract W-7405-eng-48)
(UCRL-52613) Avail: NTIS HC A03/MF A01

The capability of a four-passenger, quasi-electric drive vehicle of acceptable weight to obtain a range of 80 km with improved lead acid batteries was verified. The duel-fueled hybrid vehicle described is basically an electric vehicle (EV) augmented by a small heat-engine hybrid propulsion system for extended range capability. Usually the vehicle operates as an EV, since 75% of vehicle miles traveled in the United States consist of trips of 80 km (50 mi) or less. For longer trips, the driver may select the heat-engine hybrid mode or permit automatic switching to heat-engine power when the batteries reach a prescribed level of discharge. Three candidate propulsion systems having the greatest potential for early marketability were selected. Of the three systems analyzed, the flywheel/hydromechanical transmission configuration, requiring the smallest battery mass is the lightest and most efficient. DOE

N79-29117# Orshansky Transmission Corp., San Diego, Calif.
DESIGN AND DEVELOPMENT OF A CONTINUOUSLY VARIABLE RATIO TRANSMISSION FOR AN AUTOMOTIVE VEHICLE, PHASE 4 Quarterly Progress Report, Dec. 1977 - Feb. 1978
28 Feb. 1979 20 p refs
(Contract EY-76-C-03-1165)
(SAN-1165-10) Avail: NTIS HC A02/MF A01

Progress in developing and testing a continuously variable ratio hydraulic transmission unit for automobiles is reported. Major emphasis was placed on the development of a coaxial hydrostatic module. DOE

N79-29118# Ford Motor Co., Dearborn, Mich.
FORD/DOE SODIUM-SULFUR BATTERY ELECTRIC VEHICLE DEVELOPMENT AND DEMONSTRATION, PHASE 1 Quarterly Progress Report, 1 Dec. 1977 - 28 Feb. 1978
A. Topouzian 1978 27 p
(Contract EY-76-C-02-2566)
(COO-2566-37; QPR-37) Avail: NTIS HC A03/MF A01

Progress in developing an electric vehicle with sodium-sulfur batteries is reported. Information is included on NaS cell and battery trade off studies; preliminary vehicle packaging studies; projects on vehicle performance and cost; and motor/controller studies. DOE

N79-29119# Washington Metropolitan Area Transit Authority.
[MASS TRANSPORTATION SERVICE IN THE WASHINGTON METROPOLITAN AREA] Annual Report
Jan. 1979 27 p
(PB-293318/2; WMATA-79/1) Avail: NTIS HC A03/MF A01 CSCL 13B

The coordination of bus routes with the expanding rail system is reported as well as the current status of the Metro service. Combined annual transit trips increased by 10 million, or 4.4% over 1977. Financial statements for FY 1978 are included. The need to complete the 100-mile system plus one additional mile was affirmed. The proposed financial plan, based on the 101-mile system, covers the balance of construction, operating costs, and debt service on Metro revenue bonds. At year end, extensive activity was underway to win necessary agreements on the plan. GRA

N79-29120# General Accounting Office, Washington, D. C. Energy and Minerals Div.
THE CONGRESS NEEDS TO REDIRECT THE FEDERAL ELECTRIC VEHICLE PROGRAM
9 Apr. 1979 67 p
(PB-293977/5; EMD-79-6) Avail: NTIS HC A04/MF A01 CSCL 13F

Today's vehicles have limited commercial potential because they cost more and perform poorly compared with conventional vehicles. The GAO's review of the Department of Energy's program to develop, demonstrate, and commercialize electric vehicles recommends that electric vehicle research and development be strengthened, vehicle demonstrations be limited initially to the Federal sector, and loan guarantees for commercial production be delayed. The Congress should make the legislative changes and take other actions needed for program redirection. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N79-29121*# Illinois Univ., Urbana.
RADIO OBSERVATIONS OF ASTEROIDS: RESULTS AND PROSPECTS
John R. Dickel [1979] 10 p refs
(Grant NGR-14-005-176)
(NASA-CR-158812) Avail: NTIS HC A02/MF A01 CSCL 03A

Radio observations of the asteroids can provide information on the thermal and dielectric properties of the surface materials and because the radio emission arises somewhat below the surface, the data give some indication of layering. Observational difficulty limited the investigations to only 6 asteroids: 1 Ceres and 324 Bamberga appear to have a layer of dust covering a more compacted material; the data on 4 Vesta cannot be matched by any current models for the surface; and the results for 18 Melpomene, 31 Euphrosyne and 433 Eros are too incomplete for firm conclusions. Future possibilities include more accurate radiometry of a few selected asteroids of different tuxonomic classes and actual resolution of some of the larger objects by aperture synthesis techniques. Author

N79-29122*# California Univ., Berkeley. Space Sciences Lab.
SIMULTANEOUS X-RAY AND OPTICAL OBSERVATIONS OF THE FLARING X-RAY SOURCE, AQUILA A-1
C. S. Bowyer and Philip A. Charles Aug. 1979 54 p refs
(Grants NsG-5292; NSF AST-78-06873)
(NASA-CR-158849; UCBSSL-Ser-20-Issue-34) Avail: NTIS HC A04/MF A01 CSCL 03A

During the summer of 1978 the recurrent transient X-ray source, Aquila X-1, underwent its first major outburst in two years. The results of extensive observations at X-ray and optical wavelengths throughout this event, which lasted for approximately two months are presented. The peak X-ray luminosity was approximately 1.3 times that of the Crab and exhibited spectral dependent flickering on timescales approximately 5 minutes. The observations are interpreted in terms of a standard accretion disk model withparticular emphasis on the similarities to Sco X-1 and other dward X-ray systems, although the transient nature of the system remains unexplained. It was found that Aquila X-1 can be described adequately by the semi-detached Roche lobe model and yields a mass ratio of less than or approximate to 3.5. G.Y.

N79-29123*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
UNITED STATES ATLAS OF OPTICAL TELESCOPES
Stephen P. Meszaros Jul. 1979 29 p refs Submitted for publication
(NASA-TM-80319) Avail: NTIS HC A03/MF A01 CSCL 03A

The atlas shows the locations and gives information on optical telescopes in the United States as of mid-1979. Those instruments with mirror or lens diameters of one-half meter (20-inches) and larger are included. Generally the smaller telescopes are found in various concentrations all across the country. The larger ones are centered in the Southwest, on the West Coast, and on the island of Hawaii. G.Y.

N79-29124*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
X-RAY LINE EMISSION FROM CAPELLA
S. S. Holt, N. E. White, R. H. Becker, E. A. Boldt, R. F. Mushotzky, P. J. Serlemitsos, and B. W. Smith Jun. 1979 18 p refs Submitted for publication
(NASA-TM-80315) Avail: NTIS HC A02/MF A01 CSCL 03A

X-ray emission line components from Mg, Si, S and Fe were unambiguously detected from Capella with the Solid-State Spectrometer onboard the Einstein Observatory. The X-ray spectrum is inconsistent with an isothermal corona, and requires components between 6,000,000 K and at least 24,000,000 K for an adequate fit. An inhomogeneous corona in which the X-ray emitting plasma is confined to magnetically-contained loops appears to be reconcilable with all of the experimental evidence. G.Y.

N79-29125*# National Aeronautics and Space Administration, Washington, D. C.
A FLARING X-RAY PULSAR IN DORADO
Ye. P. Mazets, S. V. Golenetskiy, V. N. Ilinsky, V. N. Panov, R. L. Aptekar, Yu. A. Guryan, I. A. Sokolov, Z. Ya. Sokolova, and T. V. Kharitonova Jul. 1979 22 p refs Transl. into ENGLISH of "Vspykhivayushchiy Rentgenovskiy Pulsar v Zolotoy Rybe' Report 617 Acad. of Sci. USSR. Phys.-Tech. Inst., Leningrad, 1979 p 1-15 Transl. by Sci. Transl. Serv., Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75658; Rept-617) Avail: NTIS HC A02/MF A01 CSCL 03A

A study of unusual gamma-ray bursts detected on March 5 and March 6, 1979 in the KONUS experiment on the Venera 11 and Venera 12 spacecraft shows their source to be flaring X-ray pulsar in Dorado. Author

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N79-29126 California Univ., Berkeley.
A MEASUREMENT OF ANISOTROPY IN THE COSMIC BACKGROUND RADIATION OF A LARGE ANGULAR SCALE AT 33 GHz Ph.D. Thesis
Marc Victor Gorenstein 1978 115 p
Avail: Univ. Microfilms Order No. 7914619

In eleven flights, a dual-antenna microwave radiometer operating at 33 GHz (0.89 cm wavelength) flown on board a U-2 aircraft to 20 km altitude measured differential intensity between pairs of directions distributed over most of the northern celestial hemisphere with an rms sensitivity of plus or minus 46 m K/the square root of Hz. The measurements show clear evidence of anisotropy that is readily interpreted as due to the motion of the earth relative to the sources of the radiation; the anisotropy is well fit by a cosine distribution of amplitude 3.61 plus or minus 0.54 milli-degrees Kelvin, one part in 800 of 3 K, implying a velocity of 361 plus or minus 54 km/sec toward the direction 11.23 plus or minus 0.46 hours right ascension, and 19.0 plus or minus 7.5 deg declination. The astrophysical results are presented from the statistical analysis of the reduced data. Dissert. Abstr.

N79-29127 California Univ., Berkeley.
GALACTIC STRUCTURE FROM ACCURATE PROPER MOTIONS OF FAINT STARS Ph.D. Thesis
Liang-Tai George Chiu 1978 266 p
Avail: Univ. Microfilms Order No. 7914567

Proper motions of stars with V less than or equal 20.5 in SA 51, SA 57, and SA 68 were derived based on a set of Lick 3-m, Hale 5-m, and KPNO 4-m prime-focus plates. Proper motions and photographically determined V and B-V were used to construct reduced proper motion diagrams. A theory is presented for classifying the stars into different populations and luminosity classes with a probabilistic approach based on the distribution function of the reduced proper motion as a function B-V. Based on the fit of the theoretical ridge line to the observed data points in the reduced proper motion diagram, it is concluded that the Population 1 main sequence in the sample has both a higher velocity dispersion and a lower metallicity than those in the solar neighborhood. Evidence is presented for the existence of an intermediate population in the anticenter direction which severely contaminates the subdwarf sample in SA 51.
Dissert. Abstr.

N79-29128*# California Univ. at Los Angeles.
INVESTIGATION OF THE MAGNETOSPHERIC BOUNDARY PLASMA AND MAGNETIC FIELD DATA FROM EXPLORERS 33, 43, AND 50 Final Technical Report, 1 Jan. 1978 - 30 Jun. 1979
G. L. Siscoe and N. U. Crooker Jul. 1979 13 p refs
(Grant NsG-7180)
(NASA-CR-158834) Avail: NTIS HC A02/MF A01 CSCL 03B

Understanding of the plasma depletion process in the dayside magnetosheath, the nature of magnetotail boundary motion, and the geometry of the magnetospheric boundary layers was examined. A model of the dayside boundary layers, based on the hypothesis that merging occurs only for strictly anitparallel fields was developed which provides a qualitative solution to the problem of the half-wave rectifier response of the magnetosphere to the solar wind electric field. Regarding magnetotail boundary motion, consideration of the data led to the conclusion that at lunar distance, substorms are associated with very large amplitude compressional wave motion of the sausage type. A study of IMF orientation for depletion and nondepletion cases suggests that depletion is most likely to occur for angles between the IMF and the normal to the magnetopause at the measurement location near 90 deg, in agreement with predictions. Observations of the heat flux in the dayside magnetosheath plasma suggest that the energized plasma ions have their source along a given flux tube at that intersection with the bow shock where the magnetic field is most compressed. A.R.H.

N79-29129*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
UNIFIED FIELD THEORIES, THE EARLY BIG BANG, AND THE MICROWAVE BACKGROUND PARADOX
F. W. Stecker Mar. 1979 6 p refs Submitted for publication
(NASA-TM-80263) Avail: NTIS HC A02/MF A01 CSCL 03B

It is suggested that a superunified field theory incorporating gravity and possessing asymptotic freedom could provide a solution to the paradox of the isotropy of the universal 3K background radiation. Thermal equilibrium could be established in this context through interactions occurring in a temporally indefinite preplanckian era. Author

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N79-29130*# National Aeronautics and Space Administration, Washington, D. C.
DYNAMICS OF THE ACCUMULATION PROCESS OF THE EARTH GROUP OF PLANETS: FORMATION OF THE REVERSE ROTATION OF VENUS
N. N. Koslov and T. M. Eneyev Jul. 1979 31 p refs Transl. into ENGLISH of "Dinamika Protessessa Akkumulyatsii Planet Zemnoy Gruppy. Formirovaniye Obratnogo Vrashcheniya Venery", Rept. Preprint-135 Acad. of Sci. USSR, Inst. of Appl. Math., Moscow, 1978 p 1-43 Transl. by Sci. Transl. Serv., Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75641; Preprint-135) Avail: NTIS HC A03/MF A01 CSCL 03B

A numerical simulation of the process of formation of the terrestrial planets is carried within the framework of a new theory for the accumulation of planetary and satellite systems. The numerical simulation permitted determining the parameters of the protoplanetary disk from which Mercury, Venus and the Earth were formed as result of the evolution. The acquisition of a slow retrograde rotation for Venus was discovered during the course of the investigation, whereas Mercury and the Earth acquired direct rotation about their axes. Deviations of the semimajor axes of these three planets as well as the masses of the Earth and Venus from the true values are small as a rule (I 10%). It is shown that during the accumulation of the terrestrial planets, there existed a profound relationship between the process of formation of the orbits and masses of the planet and the process of formation of their rotation about their axes. Estimates are presented for the radii of the initial effective bodies and the time of evolution for the terrestrial accumulation zone. Author

N79-29131*# National Aeronautics and Space Administration, Washington, D. C.
NUMERICAL MODELLING OF THE FORMATION PROCESS OF PLANETS FROM PROTOPLANETARY CLOUD
N. N. Kozlov and T. M. Eneyev Jun. 1979 94 p refs Transl. into ENGLISH of "Chislennoye Modelirovaniye Protsessa Obrazovaniya Planet iz Protoplanetnogo Oblaka" Preprint-134 Acad. of Sci. USSR. Inst. of Appl. Math., Moscow, 1977 p 1-80 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75642; Preprint-134) Avail: NTIS HC A05/MF A01 CSCL 03B

Evolution of the plane protoplanetary cloud, consisting of a great number of gravitationally interacting and uniting under collision bodies (protoplanets) moving in the central field of a large mass (the Sun or a planet), is considered. It is shown that in the course of protoplanetary cloud evolution the ring zones of matter expansion and compression occur with the subsequent development leading to formation of planets, rotating about their axes mainly directly. The principal numerical results were obtained through digital simulation of planetary accumulation. Author

N79-29132*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
JUPITER'S MAGNETIC TAIL: VOYAGER 1
N. F. Ness, M. H. Acuna, R. P. Lepping, K. W. Behannon, L. F. Burlaga, and F. M. Neubauer Jul. 1979 23 p refs Submitted for publication
(NASA-TM-80316) Avail: NTIS HC A02/MF A01 CSCL 03B

Magnetic field observations by the Voyager 1 spacecraft during the outbound traversal of the Jovian magnetosphere in March 1979 suggest the detection of an extended magnetic tail, which has been formed by the solar wind interaction with the planetary field. The apparent diameter of the tail is 300-400 times the radius of Jupiter but its length is not measured. When combined with the GSFC O4 model of the planetary field, this magnetosphere topology leads to polar cap auroral zones approximately 20 deg in diameter, considerably smaller than earth's. The northern zone is found to be highly eccentric, encircling neither the rotational pole nor the magnetic pole of Jupiter, and limited to System III (1965) longitudes approximately 133 deg to 190 deg and latitudes approximately 62 deg to 82 deg. Author

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N79-29133# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
FOUR YEAR STATISTICS OF ACTIVE PROMINENCES
K. Ramanuja Rao Jan. 1979 29 p refs
(INPE-1417-RPE/003) Avail: NTIS HC A03/MF A01

The morphology of the active prominences in H alpha between 1973 and 1976 was studied and a power spectral analysis was done to find short periodicities in the occurrence of these prominences. A periodicity of 4.2 days of statistical significance was obtained. G.Y.

N79-29134# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
NEW UNDERSTANDING OF ENERGETIC PARTICLE PROPAGATION IN THE MAGNETIC FIELDS OF THE SOLAR CORONA AND INTERPLANETARY MEDIUM
E. C. Roelof and R. E. Gold Oct. 1978 34 p
(Contracts N00024-78-C-5384)
(AD-A067940; AFGL-TR-78-0293; SCIENTIFIC-3) Avail: NTIS HC A03/MF A01 CSCL 03/2

Significant improvements in understanding coronal and interplanetary propagation of energetic particles are summarized, and their relationship to prediction techniques is indicated. Observation and theoretical evidence is drawn from synoptic compilations of solar activity and coronal magnetic structure as well as syntheses of plasma, field and energetic particle observations between 1 and 6 AU, utilizing both solar and Jovian particles as probes of the heliosphere. Author (GRA)

N79-29135# Los Alamos Scientific Lab., N. Mex.
EVOLUTION OF THE SOLAR CONSTANT
Michael J. Newman 1978 16 p refs Presented at the 4th Coll. Park Colloq. on Chemical Evolution, Limits of Life, College Park, Md., 18 Oct. 1978
(Contract W-7405-eng-36)
(LA-UR-79-107; Conf-7810136-1) Avail: NTIS HC A02/MF A01

The ultimate source of the energy utilized by life on earth is the Sun, and the behavior of the Sun determines to a large extent the conditions under which life originated and continues to thrive. Three mechanisms by which it was suggested that the solar energy output can vary with time are discussed, characterized by long approximately 10 to the 9th power years, intermediate approximately 10 to the 8th power years, and short approximately 10 to the 8th power short years to decades time scales. DOE

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N79-29136*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HEAO A-2 EXTRAGALACTIC RESULTS
Elihu A. Boldt Jun. 1979 27 p refs Presented at HEAO

Symp., Huntsville, Ala., 8 May 1979
(NASA-TM-80314) Avail: NTIS HC A03/MF A01 CSCL 03B

The all-sky surveys made with the A-2 instrument aboard HEAO-1 involved spectroscopy over a broad enough band width, with sufficient resolution, to obtain the basic spectral characteristics for two extreme aspects of the extragalactic X-ray sky. The overall spectrum (above 3 KeV) is remarkably well decribed by a thermal model. At the other extreme, the detailed broad-band observations of individual sources are restricted to objects within the present epoch. The objects include several individual active galaxies studied in detail for the first time as well as clusters of galaxies. Relating these results to the vast spatially unresolved hard X-ray flux measured with this instruments as well as the softer X-rays (at less than 3 keV) spatially resolved to high redshifts with the Einstein Observatory remains a challenge.
Author

N79-29137# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
THE ORIGIN OF TRANSIENT COSMIC RAY INTENSITY VARIATIONS
Nunzio Iucci, Mario Parisi, Marisa Storini, and Giorgio Villoresi Nov. 1978 9 p refs
(Grant CNR-7700902102)
(LPS-78-14) Avail: NTIS HC A02/MF A01

Data collected on solar flares accompanied by Type 4 radio emission, developed in frequency from micrometric to metric wavelengths, were analyzed. The period considered was from 1957 to 1969. Cosmic ray intensity was determined using the revised data of high latitude neutron monitors at sea level up to December 1965; after 1965 the Deep River Neutron Monitor data were used. Results show that the decreases in the cosmic ray intensity, apparently related to the central meridian passage of intense active regions, are produced by the solar flares occurring in the same regions and accompanied by Type 4 bursts. Further transient decreases, generally of lower amplitude, are due either to Type 4 solar flares occurring beyond the east limb of the sun to solar wind of enhanced velocity coming from coronal hales.
Author (ESA)

99 GENERAL

No abstracts in this category.

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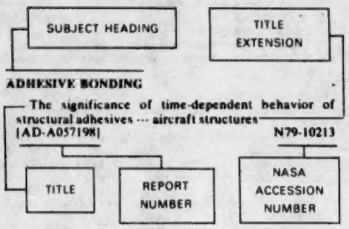

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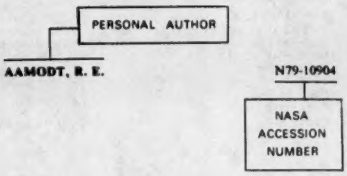

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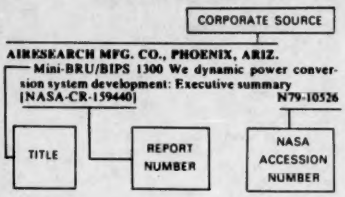

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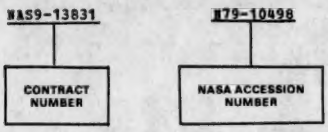

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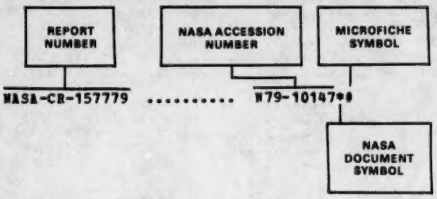

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